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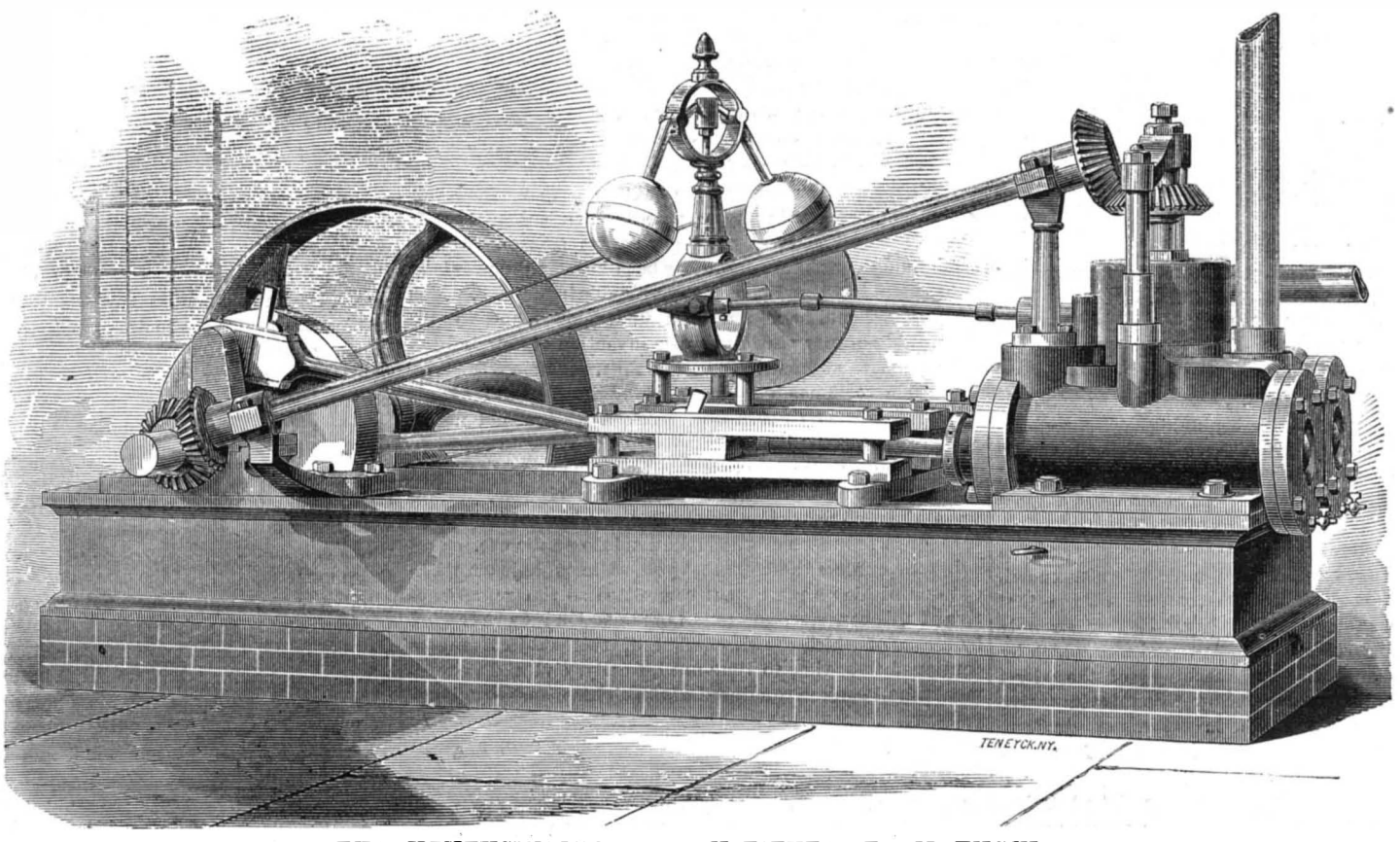
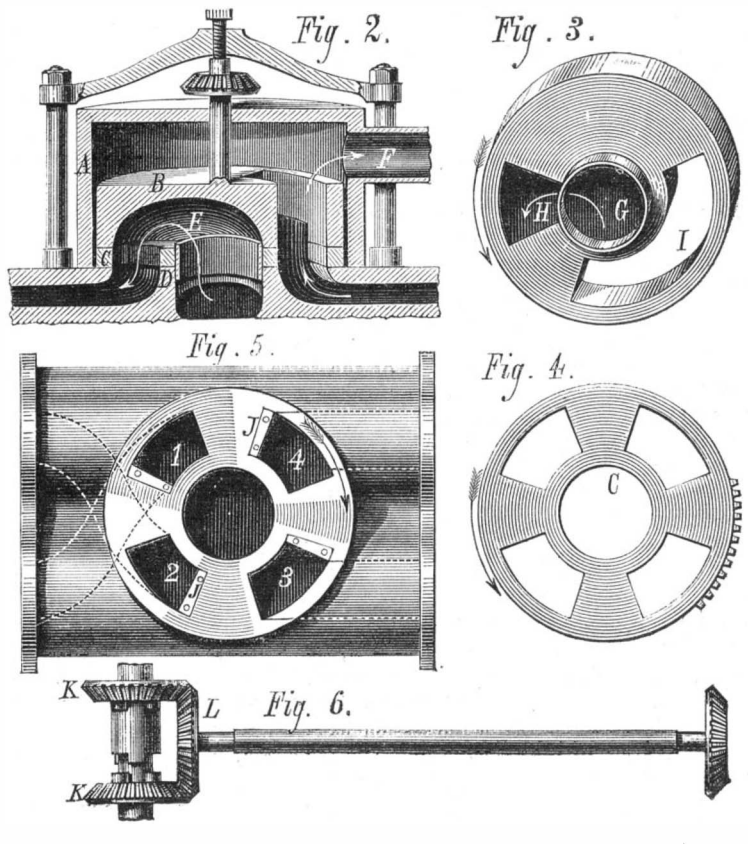
THE K. M. I. STEAM ENGINE.

The principal feature of the novel form of steam engine illustrated herewith, to which the attention of the reader is directed, is the valve, which is equally well adapted to either double or single machines. The double cylinder engine is constructed with cranks at right angles, has no dead point, and consequently requires no fly wheel, the leverage varying between one and one and a half cranks, nearly. The valve is actuated by bevel gearing communicating with similar mechanism on the main shaft, which may be in the center, or on the outside of the bed plate as represented in the perspective view, Fig. 1. To this portion of the apparatus, however, more particular reference will be made hereafter.



THE KENTUCKY MILITARY INSTITUTE STEAM ENGINE.

Fig. 2 is a section of the steam chest, A, valve, B, cut-off plate, C, and valve seat, D. The valve stem, it will be noticed, carries a bevel cog wheel above the steam chest, and is held in a suitable frame. The direction of the live steam is indicated by the bent arrow, at E, and the course of the exhaust by similar means at F. Proceeding to the consideration of the various portions in detail, we represent in Fig. 3 the bottom of the valve, B. G is the dome which, as already indicated, opens into the live steam port, H, which is cut to one eighth of the circle; I is the exhaust aperture, cut to three eighths, whence the steam passes into the steam chest, as before noted, at F, Fig. 2. Around the dome, G, is formed a short cylindrical rim which passes down through the cut-off plate, C, and into the valve seat, so as to hold the valve in place. The arrow drawn beside Fig. 3 shows the direction of the rotation of the valve. In Fig. 4 is depicted the variable cut-off plate, C, which is a thin disk of metal; in it are four openings, which correspond with similar apertures, each equal to one eighth circle, in the valve seat, Fig. 5. These orifices embrace the stops, J, Fig. 5, which are pieces of metal secured to the valve seat and of the same thickness as the cut off plate. The object of these stops is to prevent the movement of the plate from affecting the points of admission of steam into the cylinders. The plate is controlled by the governor by means of suitable mechanism connecting with the cogged octant, formed at its circumference and fitting in a recess in the side of the steam chest. It is stated that the governor adjusts the cut-off, by moving the plate, with the greatest ease, the valve gliding over the latter with very slight friction.



The valve seat, as shown in Fig. 5, is pierced for a double cylinder engine. The openings, 1 and 3, connect with the right cylinder, and 2 and 4 with that on the left, the steam ways crossing, as indicated by the dotted lines. The valve moves over the seat in the direction of the arrow, Fig. 5, which, as before noted, is pierced for a fixed cut off at half stroke, since one eighth passing over one eighth gives one quarter revolution or one half stroke; while, as the exhaust port is cut three eighths of circumference, necessarily three eighths passing over one eighth gives one half revolution, or full stroke for exhaust.

According to the inventor, this valve is capable of these modifications as follows: First, the valve constitutes the steam chest, the steam taking the ordinary course, the live steam port connecting with the steam chest and the center dome connecting with the exhaust port, which opens downward only, the joints being visible and showing any leak that may exist.

In the second, the course of the steam is reversed; the live steam port of the valve opens into the center dome. The exhaust port, opening upward, discharges the exhaust steam into the steam chest above the valve. This modification is already described and shown in Fig 2.

In the third plan, a part of the top of the steam chest is attached to the valve stem, in surface slightly less than the bottom of the valve, producing a balanced valve, the top of the steam chest being reduced to a narrow outer rim. The steam, entering at the side of the chest, takes the ordinary course.

Fig. 6 shows an ingenious device employed for connecting the cog gearing which actuates the valve with the main shaft, whereby the movement of the latter may be instantly reversed without altering the direction of rotation or the motion of the valve. This is not shown in the engine in Fig. 1, but is usually placed on the center of the main shaft, the cylinders being separated for a few inches. Both of the bevel wheels, K, are loose upon the shaft, and between them works a similar wheel, L, upon the rod which connects with the valve gear. Between the wheels, K, and sliding loosely upon the shaft, is a sleeve forming a clutch which may be brought into action, as plainly indicated, with either. The sleeve, although moving freely along the shaft, is rigidly connected with it by a feather and slot, so as to partake of its rotary motion. It is evident, therefore, that the wheel, L, thus receives its motion from but one wheel, K, while the other is inoperative, and hence, as is evident from the arrangement of the gearing, may, by altering the position of the sleeve, be caused to rotate always in the same direction.

The claims of the inventor regarding the merits of his device, advantages which we learn secured for it much attention and favorable comment at the recent Louisville Exposition, may be briefly summed u as follows: That, in dispensing with the fly wheel and the eccentric, and in the free movement of the valve, there is a saving of a great part of the resistance arising from the moving parts of the engine itself. That the double engine costs no more, and the single engine less, than the common non-cut-off engine of the same power. That in economy of steam, and consequently of fuel, it accomplishes all that engines of the highest grade can accomplish, while it is remarkable for simplicity and cheapness of first cost. That it cannot get out of order except by breakage or wear of parts, and can be managed by an unskilled hand. The valve, it is also stated, can be attached at small expense to engines now running, giving them the fixed and automatic cut-off, with a saving of half the fuel for the same amount of work. The double engine, it is believed, has peculiar adaptation to road steamers, steam plows, etc.

Our engraving is taken from a photograph of this form of the machine, as exhibited at the above mentioned exposition.

Patented September 9, 1873. For further information address the inventor, Colonel R. T. P. Allen, Superintendent Kentucky Military Institute, Farmdale P. O., Franklin county, Ky.

The Cotton Window in the Guildhall, London.

Mr. W. J. Cotton, a London merchant, and an alderman, has recently presented to the city a stained glass window, in commemoration of the troublous times of the scarcity of cotton during our late civil war, and the generosity of the Londoners in aiding the Lancashire operatives. Alderman Cotton was a zealous worker on behalf of the relief fund; and if, by accident, the memorial window perpetuates his own name, no one will grudge him the distinction.

The window illustrates the cotton plant, in the different stages from its growth to its final application to clothing, by twelve medallion pictures, showing sowing, growing, picking, packing in the field, loading at New Orleans, at sea in an American clipper, discharging in the London Docks, carting, in transit on the rail, the Manchester Piccadilly (the Cottonopolis), manufacture in cotton mill, and wearing, the last named being a family group. The color of the ground work is lavender; the borders are ruby, with an amber ribbon; the designs are filled in with ruby, amber, and lavender, the gothic scroll work being brownish white.

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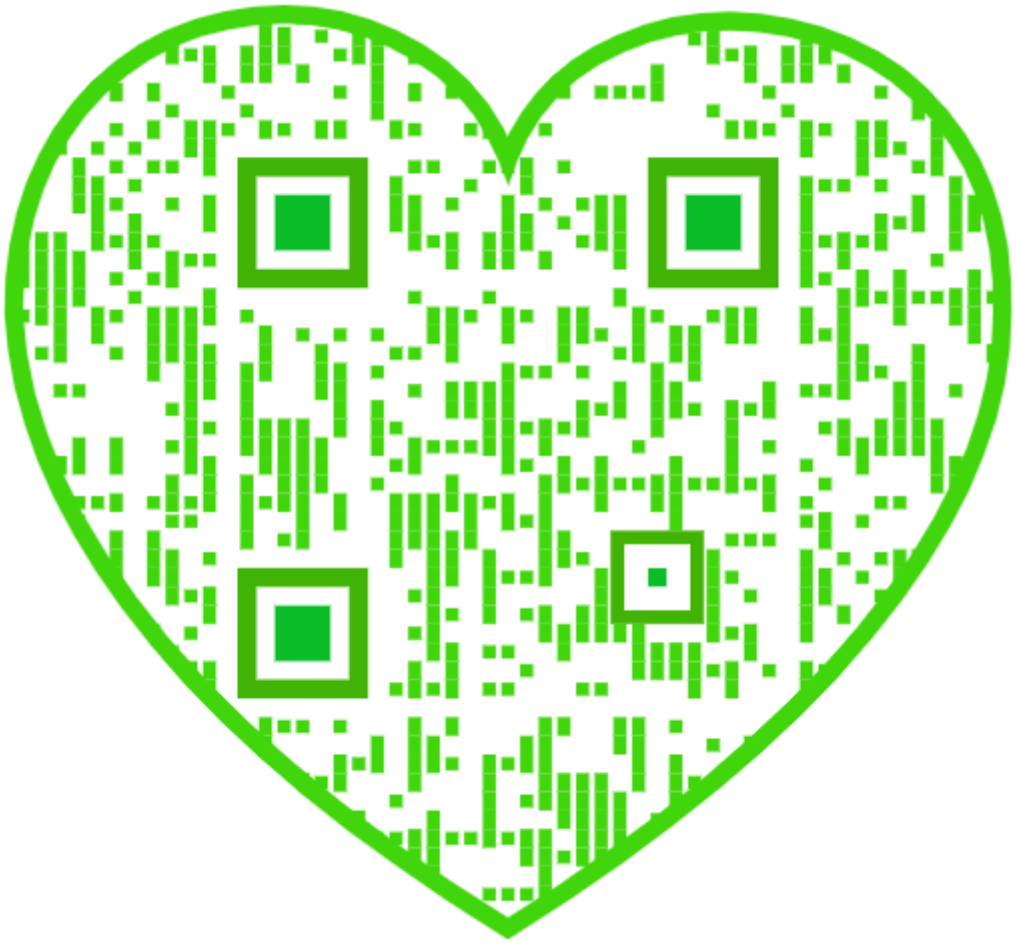

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THE VALUE OF PATENTS.

A recent number of the *Official Gazette* contains a full report of the address delivered by Mr. J. M. Thacher, our present Assistant Commissioner of Patents, before the so-called Patent Congress, at Vienna, last summer. In this effort, Mr. Thacher begins at the beginning, avers that invention is "the product of the highest faculties given by God Almighty" to man, and therefore ought to be secured to him by letters patent. He declares that man has a more valid right to the exclusive possession of his inventions than even to his landed estates, and perceives no obligation on the part of the inventor or discoverer to disclose new knowledge to others, unless permitted to control and use that knowledge as he would other property. Having strongly insisted upon the correctness of these propositions, which by the way are at variance with the teachings of the wisest philosophers, he next proceeds to show that this inventive property, these natural rights of the inventor, ought by law, to be taken away from the originator after he has for a limited period enjoyed their possession.

In relation to official examinations at the Patent Office, our author is of the opinion that the inventor, whose mental genius and discernment are eloquently lauded throughout the address, is incompetent to examine the novelty of his own invention, and determine for himself whether it is worth his while to pay in the official fees and take out a patent. Nor is the inventor's attorney qualified to solve this momentous question. It should be left, Mr. Thacher says, to a corps of scientific experts; but, as he thinks they may be liable to err, he suggests that there ought to be another set of experts to re-decide the decisions of the first experts. This, in fact, is the way the thing is done at Washington. One hundred of these scientific gentlemen, aided by four hundred clerks and helpers, all of whom are supported at the expense of the inventors, now officiate at the Patent Office, but Mr. Thacher wishes to increase the number. "Unfortunately," he says, "it is the pocket that controls men, more or less, in every station and in every country." It is indeed a misfortune for our inventors that their pockets are obliged to control and supply so large a number of examining officials. Save us, we say, from any increase. We are glad to turn from the mazes of the metaphysical portion of the Assistant Commissioner's address to that branch which relates to the practical results and values of inventions, for here we find information, useful and interesting to everybody. He says:

"The number of patents granted since 1836 is about 140,000. The number of applications for patents has steadily increased from year to year, until it now averages from 20,000 to 21,000 per annum, and the number of patents granted annually is from 13,000 to 15,000. To perform the work of examining this large number of applications, the corps of expert examiners has been increased from time to time, until it now numbers about 100—to wit, 24 principal examiners, and the same number of first, second, and third assistant examiners, together with a special examiner of trade-marks and also of interferences. The clerical force has been correspondingly increased, so that officials of all grades now employed in the Office may be stated in round numbers as about 500.

The bare statement of the number of patents granted since 1836 is sufficient to bear me out in the statement that our system has proved to be a most remarkable stimulant to inventive genius, not only in our own country, but throughout the world. But you will very naturally inquire. How many of these patents are valuable? Of course it is impossible to obtain statistical information that shall be entirely reliable on this point, but my official experience has given me such data that I am enabled to form an opinion approximately correct. I have discussed the matter with others, and have sought information from manufacturers, patentees and legal gentlemen who have made a specialty of the practice of patent law, and I think I do not exaggerate at all when I say that one half of the patents granted in our country may be considered remunerative. Now I do not wish to be understood by this that one half of these 140,000 patents have brought fortunes to the pockets of the patentees. They have become remunerative to a certain extent—that is, they have paid expenses and something more. A small proportion of them have become largely remunerative, and the patentees, or their representatives, have obtained large fortunes from them. I think, therefore, it may be said that the influence of our system upon inventions and inventors themselves has been beneficial beyond all expectation.

But you will also ask: What has been the influence of our patent system upon the manufacturing interests of our country? I have taken occasion to make some inquiries upon this point also. A short time before I left Washington the Secretary of State sent out, to inventors, manufacturers, and others interested in patents, a series of inquiries, among which were some as to the influence of our patent system upon the manufacturing interests of the country. With scarcely an exception, so many of our manufacturers as responded answered that the patent system was beneficial, beyond all manner of doubt, to the manufacturing interests of the country. It is estimated, both by myself and others who are qualified to judge of this matter, that at the present time from six to seven eighths of our enormous manufacturing capital is based upon patents, either directly or indirectly. In fact, it is almost impossible to organize a company for manufacturing purposes in America without first securing the control of patents for some valuable invention.

I think, then, that we may be said to have reached this conclusion, that our inventors, patentees, and manufacturers have all benefited greatly by our patent system. At the same time the public welfare has been greatly promoted by the general introduction of many valuable inventions, which otherwise would have remained undeveloped, and by the cheapening of many articles by the invention of new and improved modes of manufacture. At the same time we believe the whole world has been benefited by the liberality of our law. We make no distinction between foreign and native applicants, but invite inventors from the whole world to give us the benefit of their inventive genius upon the same liberal terms that we grant to our own citizens, putting upon them no restriction as to time or place of manufacture, or introduction of the invention into public use. * *

Let me express the hope that you will not adjourn without establishing a permanent committee as the representative of this congress, so that an organization may be created by means of which the discussion of this subject may be continued from time to time until, finally, civilized governments shall become convinced of the righteousness and expediency of the principles here advanced, and there shall be universal recognition of the rights belonging to, and the public benefits conferred by, the inventors of the world."

A NEW AND IMPORTANT DISCOVERY RELATING TO THE BEHAVIOR OF METALS UNDER STRESS.

In calling attention recently to the original investigations in progress at the Stevens Institute of Technology, it will be remembered that we referred in some detail to the interesting and valuable experiments which Professor R. H. Thurston is conducting with a view of determining the torsional resistance of various metals. The machine used for this purpose is an apparatus of the Professor's own invention; and although we have already alluded briefly to its construction in another connection, it may be of interest for the reader to review its salient points, in order to understand with clearness the highly important discovery which has just been effected through its aid. A triangular cast iron frame supports two suspended arms which swing about independent axes in the same line; one arm carries a weight, and the other has a handle at its extremity, by which it is moved. Each of the axes has a rectangular recess, in which each end of the test piece, previously squared, is fitted. The frame carries also a guide curve of metal, so constructed that its ordinates are proportional to the twisting moments exerted by the weighted arm while swinging through an arc to which the corresponding abscisses are also proportional. A pencil holder bears against the guide curve; and being carried by the weighted arm, is thrown forward as the latter swings out under the action of the force producing torsion, which force is transmitted through the test piece. The handle arm carries a table upon which a piece of paper is clamped, so that the pencil traces thereon a curve, the ordinates of which are proportional to the torsional movements, while its abscisses represent the relative motion of the two arms and, consequently, the amount of torsion to which the test piece has been subject. This line, therefore, gives a very legible and accurate record of the results of each experiment.

During the recent visit of the members of the Academy of Science to the Stevens Institute, Professor Thurston took occasion to explain his researches and to illustrate the power of his device in exhibiting the action of the molecular forces under stress. After the session had adjourned, a test piece was left in the machine under heavy strain, in order to determine if possible the existence of viscosity, which had been suspected in the metal. On examining the piece twenty-four hours later, the investigator discovered, to his surprise, that not only could no evidence of yielding be detected, but that, on his attempting to produce further distortion, an even greater resistance was offered than when the first stress was applied. The curve traced by the pencil, instead of being coincident with the line previously described, became parallel therewith, and some twenty per cent higher above the axis of abscisses.

Repeated experiment has confirmed this remarkable discovery, and Professor Thurston considers that he has substantiated the fact that metal, strained so far as to take a permanent set and then left under the force producing stress, actually gains in power of resistance up to a limit of time, which in these experiments was about seventy-two hours, and to a limit of increase which has a maximum, in the best irons, of about twenty per cent. We need hardly point out the importance of this conclusion, which, though it has been suspected for some time by many engineers and men of science, is now for the first time definitely proved. The result is of course negative, and necessarily completely upsets the common notion that metal continuously strained beyond its limit of elasticity loses its strength.

We understand that further experiments will be speedily made, so that we hope to be enabled before long to lay before our readers more detailed information, together with copies of curves and other interesting results obtained. We note with pleasure that numbers of specimens of cast, wrought, and malleable iron, steel and many other varieties of metal, are being sent to Professor Thurston by prominent manufacturers in all parts of the country; so that the coming investigations bid fair, not only to add greatly to the already well earned reputation of their author, but largely to the knowledge of the scientific professions.

PATENTS FOR SIMPLE THINGS.

In a recent application for a patent for an improvement in attaching metallic heels to boots, the invention consisted in extending the outsole the whole length of the boot and in fastening the heel upon such outsole. The application was rejected for the reason that it was not new to carry back the outsole as described, nor was the heel new; therefore the attachment of a heel to such sole was not an invention, though the ordinary method was to attach the heel to the insole, the outsole being only extended up to the heel. The applicant appealed to the Assistant Commissioner of Patents, who reversed the decision of the Board of Examiners, and held that, however small or insignificant an invention appeared, it ought to be patented if useful. In this case, the attachment of the heel to the outsole made a firmer fastening for the heel, was better than the common plan, and therefore patentable. This is good doctrine; and if the Patent Office would only stick to it and carry it out into practice with uniformity, the interests of inventors would be greatly promoted. But, unfortunately, the decisions of the Patent Office are irregular. It too often denies on one day what it grants the next day. We cannot always rely upon the Office to issue patents for simple improvements, like roasted persimmon seeds, a knot upon the thread of an envelope, or, as in this case, nailing a heel upon the bottom of a boot. Yet it is for the issuing of patents upon just such simple improvements that 100 principal examiners and their 400 helpers are thought by some people to be necessary, and for whose support inventors are taxed.

BOSTON REBUILT.

Just one year has elapsed since the occurrence of the disastrous conflagration which laid one of the fairest portions of the city of Boston in ashes. Sixty-five acres constituted the extent of the burned district; 776 buildings were consumed, and an aggregate total of $75,000,000 lost. The destroyed edifices were insured to the amount of $56,000,000; and of this sum $34,000,000 has, it is stated, been paid, although twenty-six Massachusetts insurance companies have failed in consequence thereof.

Shortly after the calamity, a building act was passed, which was designed to provide in a measure against similar casualties arising from like causes. This law forbids mansard or other roofs being more than one story high or more than twenty feet above the upper floor of a building, unless fireproof throughout. Bay windows are not to be constructed at a hight exceeding three feet above the second story. Exteriors of structures above forty-five feet high must be covered with incombustible material; if over sixty feet, they must be fireproof. The limit of hight of buildings is fixed at seventy feet, and party walls bounding lofty roofs must be carried at least two and a half feet above the same, and be corbelled and coped with stone or iron. With these regulations in force, and with the teaching of experience before them, the citizens have proceeded with the rebuilding of their ruined edifices; and as a result, structures have been completed and are still rising which, it is believed, will not succumb even before a repetition of the great fire.

The burnt section included 31 streets, 8 places, 5 squares, and 1 court; in reconstructing which 17 streets have been widened, 4 extended, and a large square laid out, at a total cost to the city of over $5,000,000. The general plan of the streets is little altered; 365 buildings have been erected or are in progress, of which 115 are finished and occupied, 10 unoccupied, and 240 uncompleted. Among these, there are but 72 mansard roofs against 264 flat roofs, the former being either wholly of brick or iron, or else covered entirely with fireproof material. The majority of the edifices are of four stories, there being but two, one of six and the other of seven stories, exceeding this hight. The external and party walls are all 20 inches thick to an elevation of two stories above the street, and 16 inches thence to the roof. The "fire walls" which surmount the party partitions are of the hight above noted and 12 inches through. Galvanized iron is largely used for cornices, and, with cast iron, for exterior finish. The total cost of the completed buildings is $3,762,500 and they cover 1,192,918 superficial feet of ground.

As regards architecture, we learn that many of the edifices

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will be of exceptional beauty and magnitude. The majority are of the modern gothic order, and much ingenuity of design is manifested in constructing the flat-roofed buildings so as to avoid the unfinished appearance incident to the abrupt termination of the façade. Three great structures are to be erected by the New York Mutual Life, the New England Mutual Life, and the Equitable Insurance, companies, which are to be of magnificent design, and, with the new Post Office and Rialto building, are to be completely fireproof throughout. There are also a number of warehouses and other mercantile edifices, which in many instances are more spacious and elegant than those which they have replaced.

The same energy which has made Chicago rise from a heap of ruins into a grander and even more magnificent city than before, has within the short space of a year blotted out the recollection of an almost overwhelming disaster, by labor which seems all but Herculean. Hardly had the story of the calamity ceased to be the current topic of thought before workmen were busily laying foundations, and this in the face of losses which dealt a blow to the entire business community of the nation. Not only the people of Boston, but of the whole United States, may well be proud of such indomitable enterprise. It adds but another proof, to that already shown by our unfortunate war, that in this country we know neither the extent of our energies nor of our resources, until the same are put to the trial which demands their strongest action.

PHYSICAL AND MENTAL OVER-CULTURE.

A noted British novelist, now on a visit to this country, in one of his most popular narratives, exemplifies the case of an athlete who, by a severe course of training, has brought himself to a high state of physical perfection, in order to compete in the lists of a foot race. When the time arrives for the test of his powers of endurance, the runner begins his task; but ere he can reach the goal, his overtaxed system gives way, and he falls stricken with paralysis, a hopeless bodily wreck. Instances of similar kind in real life are but too common. The death of the celebrated oarsman Renforth while at the thwart is still within public recollection, and the decease of Heenan, the once famous pugilist, is a more recent exemplification of the retributive action of Nature when the laws by which the confines of the possibilities of human muscular effort are transgressed.

A man's body may be compared to a finely adjusted and accurately balanced steam engine, and his vital energy and mental power to a constant motive force acting upon a uniform area of piston. It needs no demonstration to prove that an engine has a certain fixed capability; it can develope so many horse power, and then reaches its limit. If we make more ponderous wheels or stronger rods and shafting, equal to the performance of much more arduous work, and then expect that the same power, merely by operating such heavier machinery, will produce increased results in overcoming greater burdens, common sense tells us that we look for an impossibility. And yet this is precisely what we seek to accomplish by causing exaggerated muscular development. We destroy the equilibrium of the machine; and as a result, the action of the power by which it is set in motion is either weakened or arrested. The physical seats of vital energy in the human frame are in the so termed vital organs: as in the overtaxed steam engine the molecules of vapor dash and expend their force against the piston unproductive of any motion, so in the body; one part (the heart) unable to drive the increased flow of blood required for the augmented needs of other members, becomes overwrought and eventually diseased; the lungs, equally unable to maintain the process of burning up the effete matter poured into them by the veins, degenerate and waste away; and the brain, failing to establish the connection between motor nerves and will, shatters by paralysis the delicate mechanism. All, in fine, are causes which as surely arrest the motion of the human machine as does the load beyond its powers that of the apparatus of iron and steel.

The case of Heenan illustrates these truths perhaps as forcibly as any that can be cited. The man was a model of physical perfection, not ponderous in build or gigantic in frame, but to all appearances one in whom the parts of the body, while cultivated to their full extent, remained in statuesque symmetry. And yet despite the capacious breast and broad shoulders—points in themselves supposed to indicate almost unlimited strength of lungs—these last mentioned members, in the constant strain upon the system, proved unequal to their task, and fell prey to the wasting and insidious disease which resulted in death.

While, with such evidence as this before us, the tenets of the ultra advocates of "muscular Christianity" may well be questioned with reference to the benefits derivable from the attainment of a so called high physical condition, on the other hand, it is true that no less dangerous results are to be apprehended from the converse practice, the development of the mind at the expense of the body.

Again referring to the steam engine for a simile, let us consider the consequence, supposing that working parts and load remained constant, of our crowding into the cylinders an enormous steam pressure. Manifestly there would be either a much more rapid wearing out of the machine, caused by the overwhelming power, or more probably the complete breakdown. Thus it is with the individual who, by excessive study and brain work, overweighs the balance in the contrary direction, and, by neglecting to maintain the equilibrium of mind and body, succumbs to the impoverishment of his physical system. Illustrations in point are to be found among the members of every profession, among the students of every institute of learning. Young men, ambitious to gain scholastic honors and spurred on by the applause of preceptors and friends, too often find failing health and despondent spirits the precursors of permanent bodily infirmity, induced by overstrict application, too many hours of study, absence of simple and nourishing food, and neglect of wholesome exercise. Undeterred by premonitions of Nature, toward the close of their course, in order to reach a coveted prize—as valueless to them in after life as it is intrinsically worthless—they tax their energies beyond their powers of endurance. Then, as the runner in the race or the oarsman at his oar physically breaks down at the moment of trial, so the overworked brain succumbs when it is subject to the final strain. The student, whose hollow eyes, pale face, and wasted form denote nights of unvaried toil, finds his powers inadequate to do him justice, and his memory fleeting at the hour when he desires their firmest aid; and he endures the bitter experience of seeing others, intellectually beneath him but physically his superiors, withstand a trial before which he fails.

Study is to the mind as exercise is to the body: both alike act as developing powers, but neither body nor mind can be carried to a relative excess of cultivation except at the expense of the other. *"Mens sana in corpore sano"* does not refer either to pundits or prizefighters. It means a mind well balanced, well organized, and varied in ability, coupled with a body healthy, vigorous, and strong—the one capable of grappling with the highest thoughts and ideas, the other with the deepest ills and obstacles incident to every walk in life.

BOILER EXPLOSION.

While a commission of scientific experts are busily engaged in expending $100,000 in discovering the occult causes of boiler explosions at one extremity, comparatively speaking, of this city, at the other end of the town a body of laborers, headed by an engineer, endeavor to lift and transport a steam boiler (with a blazing fire under it and subjected to a heavy pressure of steam) by means of crowbars placed underneath. As a result of which (in the opinion of the engineer directing the job), and attributable to the canting of the apparatus from one side to the other, causing sudden flows of water to the highly heated surface of the boiler, thus too rapidly generating steam, a terrific explosion ensues, seven persons are slaughtered, and a dozen or more seriously wounded.

The scene of the tragedy was in Fourth avenue, near 128th street, at which point the tunnel for the underground track of the Hudson River and other railroads is in process of construction.

The boiler was of the upright tube style, about 6 or 7 feet high and 44 inches in diameter. It had a square fire box, with horizontal tubes in the upper portion and vertical tubes from the top of the same to the boiler head. The fracture took place in the center of the shell; the largest fragment, some 1,000 pounds in weight, landing in the fourth floor of a building 550 feet distant. It is stated that the boiler had been recently tested to 120 pounds pressure, and was considered in every way safe, while the engineer positively asserts that the gage, just previous to the accident, did not show any extraordinary amount of steam.

PHOSPHOR-BRONZE.

Combinations of phosphorus with bronze alloys are not new to the chemical laboratory. Phosphurets of copper were produced in the middle of the last century, and have since frequently been examined and their properties carefully studied.

Without considering many minor investigations which have been made regarding this important alloy, we may here note at once that the most complete researches are those of Messrs. Montefiore-Levi and Kunzel, of Val Benvit Nickel Works, near Liège, Belgium. As far back as 1860, this firm was engaged in an elaborate inquiry into the means of improving gun bronze, and in 1868–70 conducted a very extended series of experiments for the Russia government. The results of these as well as of subsequent trials are well summed up by M. Dumas in a note to the French Academy of Sciences. He says: "The characteristics of the alloys change. The color, when the proportion of phosphorus exceeds ½ per cent, becomes warmer, and like that of gold largely mixed with copper. The grain and fracture approximate to those of steel. The elasticity is considerably increased, the absolute resistance under a fixed strain becomes in some cases more than doubled: the density is equally increased, and to such a degree that some alloys are with difficulty touched by the file. The metal, when cast, has great fluidity, and fills the mold perfectly to the smallest details. By varying the dose of phosphorus, the particular characteristic of the alloy which is most desired can be varied at will."

We can now proceed to the consideration of the most recent data obtained from experiments lately concluded or actually in progress in Europe, and reported in a recent issue of the *Engineer*. In Germany trials are being carried on at the Royal Academy of Industry in Berlin, to ascertain the qualities and capacities of the metal under heavy strain, and especially the comparative resistance to often repeated strains, whether tensile or inflecting. A bar of phosphor-bronze tried under a constant strain of 10 tuns per square inch resisted 408,230 pulls of this amount: while a bar of ordinary bronze broke before the strain of even 10 tuns per square inch had been attained. A bar of phosphor-bronze under 10 tuns of strain resisted 862,980 bends, while the best gun metal broke after 102,650 bends. Another bar of phosphor-bronze, now being tested under 9 tuns strain, has thus far resisted 1,260,000 bends. In Austria, the following comparative results have been obtained:

	Absolute resistance.	Point of elasticity.	Stretch in percentage.
Phosphor bronze	81,795 lbs. per sq. in.	54,915 lbs. per sq. in.	1·6
Krupp cast steel	72,258 " "	14,450 " "	11·0
Ordnance bronze	31,792 " "	5,562 " "	15·0

Best English copper sheets lost during six months immersion in sea water 3,058 per cent. Phosphor-bronze sheets lost only 1·158 per cent.

In Belgium, Messrs Montefore-Levi & Co. have carried on a large series of experiments, proving that the presence of oxide of tin and suboxide of copper lessens the tenacity, elasticity, and tensile strength of the bronze. Shavings of old bronze were melted, and a bar cast at 1595°C. The remaining liquid bronze was poled, and a second bar cast at 1668°C. The remaining metal was de oxidized with phosphorus, and a bar then cast at 1614° C. The three castings were made out of the same crucible and in the same manner, into three iron molds. The results found were that the old bronze had tripled its tenacity, 6·8 as against 2 per cent, and considerably augmented its absolute resistance (2384 to 1613).

In England, Messrs. Alexander Dick & Co. have recently established, in London, a special foundery for phosphor-bronze casting, and are also to produce sheets, wire, etc. Experiments, made for this firm by Mr. D. Kirkaldy and carefully tabulated, show the great superiority of phosphor-bronze for all articles hitherto manufactured of ordinary bronze or gun metal. What steel is to wrought iron it seems that phosphor-bronze is to ordinary bronze. Another table gives the tensile strength and resistance to torsion of various wires, showing also a large superiority in these particulars of the alloy over other metals. In fact, referring to the increment of tensile strength gained by phosphor-bronze when drawn into wire, it is considered that the same is astounding; and the *Engineer* adds that, even with a large margin reserved for probable error, enough remains to prove that phosphor-bronze, drawn into wire or laminated into sheets, must prove, if practicable to be produced with perfect uniformity, a most important addition in future to the list of our constructive materials. Having pliability, with a tensile strength approaching that of steel, the specific gravity of bronze, and nearly the electric conductivity of copper, it cannot fail to have important applications for the electric telegraph engineer. For small articles, now made of brass, such as curtain rings, picture frames, etc., the same, cut from spirals of phosphor-bronze, with the ends soldered so as to avoid annealing the wire by conducted heat, would be an immense improvement. Although experiments toward using the alloy for artillery are incomplete, it is probable that further investigation may demonstrate its fitness for that purpose. We have already published a long paper on its employment for tweers, for which it offers the advantages of greatly increased toughness and density, and consequent great resistance against change of temperature and the influence of molten masses. Finally, should copper become cheaper, say to double the cost of an equal weight of wrought iron, phosphor-bronze might be used in place of iron in shipbuilding. It is superior to Muntz yellow metal, a substance patented by John Scott Russell for the latter purpose, in that it does not become crystalline and brittle, while its passive strength is four or five times as great

With our vast deposits of copper, notably in the Lake Superior region, there appears to be every facility for the prosecution of investigations leading to the manufacture of this important and valuable alloy in the United States. We therefore consider that the subject merits the careful attention of American metallurgists, who, we trust, at no distant period, will contribute the results of their own experiments to those thus far adduced by their brethren of the old world.

SCIENTIFIC AND PRACTICAL INFORMATION.

A NEW ELECTRIC LIGHT.

M. Ladiguin has recently invented a new plan for electric illumination, which is quite simple, and which, it is believed, may be advantageously used for lighting mines, as there is no danger of its causing the explosions incident to such localities. It consists in a bit of charcoal or other poor conductor attached to a wire communicating with a magneto-electric machine. The charcoal is enclosed in a glass tube in which the air is replaced by a gas which will not combine with the carbon when the same is brought to a high temperature. The tube is sealed, and the machine set in motion by a small steam engine or other motor, when the charcoal gradually becomes incandescent, emitting a pleasant and quite brilliant light, the intensity of which, it is said, may be graduated at will.

THE ACTION OF ANTISEPTIC SUBSTANCES UPON VIRUS.

M. Davaine has recently examined the following substances, which he classes in regard to their power as antiseptics in the subjoined order: Ammonia, silicate of soda, ordinary vinegar, and carbolic acid; then caustic potash, chloride of oxide of sodium (?), hydrochloric acid, permanganate of potash, chromic acid, sulphuric acid, iodine. The power of ammonia, of vinegar, and of carbolic acid being represented by 1—200, that of iodine would be by 1—12,000. Iodine should therefore be considered as the best antiseptic to be employed in the treatment of maladies such as malignant pustule, boils, carbuncles, and the like, when, not having become localized under the form of a simple pustule, they have taken up a certain extension. Injections of 1-6000 of iodized water are recommended.

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IMPROVED CHURNING APPARATUS.

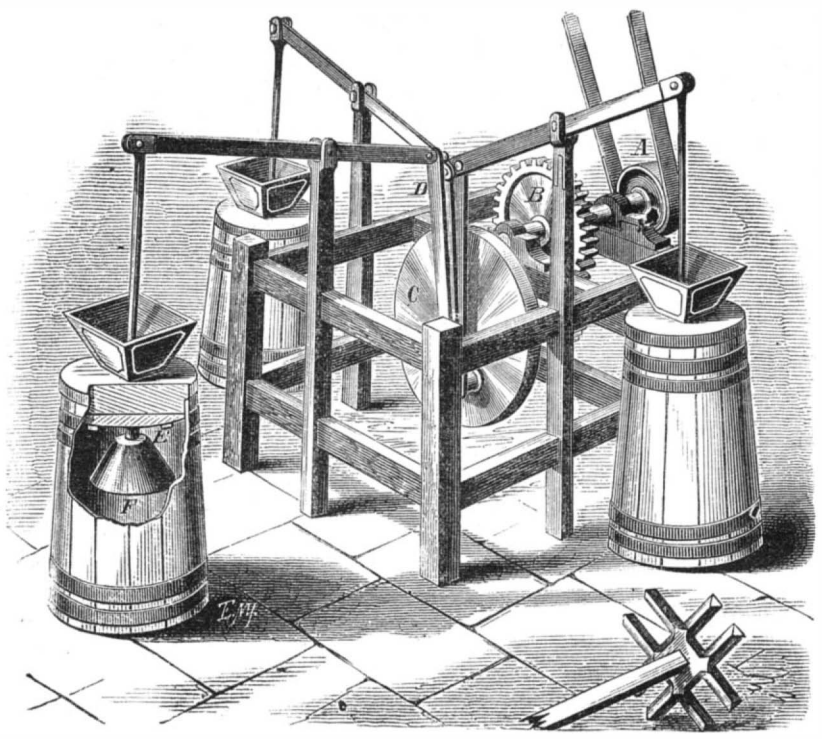
The object of the device represented in the annexed engraving is to furnish a convenient means of operating a single churn or any desired number of churns at once, in accordance with the amount of milk used and power to be applied.

To the end of the driving shaft is attached a hand crank or a pulley, A, which is connected by a belt to a suitable motor. The shaft rotates in bearings in the framework of the machine, and carries a large gear wheel, B, which, through a smaller wheel below, actuates a balance disk, C. To a crank pin on the latter are connected the rods, D, which, through the horizontal levers pivoted to supports on the frame, communicate motion to the churn dasher shafts.

The frame of the apparatus may, if desired, rest upon a platform, in which recesses may be made for the reception of the lower portions of the churns. The peculiar form of dasher represented in the foreground of the engraving is made by halving two bars to each other and attaching them at their centers to the extremity of the dasher handle. The middle portions of the ends of the bars are cut away, and the arms thus formed are made V shaped upon the upper side, while they have grooves of similar contour on their lower faces. The under side of the middle portion of the dasher is concaved, in order, it is stated, to gain a better hold upon the milk and to prevent spattering.

In the cover is formed a chamber, of which the funnel shown forms an upward continuation. The object of the chamber is to receive the milk and fine butter which may be carried up by the dasher shaft. Its bottom is formed by attaching to the cover a plate, E, the under side of which is made convex, so as to scatter the milk that may be projected against it by the dasher. This plate is secured by screws and may be readily removed for cleaning, etc.

Instead of the form already described, the dasher may be made of the shape shown at F, its upper side being conical, and its base slightly concave. The invention is of simple construction, and, according to the inventor, of very efficient operation. He informs us that a child, by its aid, using a simple churn, can easily produce butter from four gallons of cream in ten minutes, and that with three churns, actuated by one horse power, thirty gallons can be similarly treated in fifteen minutes. Patented through the Scientific American Patent Agency, November 4, 1873. For further information address the inventor, Mr. George Ridler, Rickardsville, Dubuque county, Iowa.



RIDLER'S IMPROVED CHURNING APPARATUS.

A New Torpedo Boat.

A new torpedo boat was lately launched with success at the Navy Yard, Brooklyn, N. Y. It is a double hull vessel, being built with two vertical sections and five watertight bulkheads, and will be furnished with a vertical wheel of peculiar construction, by means of which she will be guided as well as propelled. She is constructed wholly of iron, is 175 feet long, 28 feet wide, and 14 feet deep. On the bow she will carry a gun of 11 inch caliber, and on either side and on the bow two torpedo booms will project. The torpedo has been building for two years, and she will not be finished until next year.

What Made the Chimney Fall?

At the cement works of Gostling & Co., Northfleet, Eng., the upper part of an immense chimney, 220 feet high, composed of the best bricks and mortar, grouted with Portland cement, recently fell, just as the last brick for its completion was being laid. Seven lives were lost. The remainder of the chimney was subsequently torn down. An official enquiry as to the cause of the disaster was held. The jury were unable to decide what made the chimney fall, and brought in a verdict, in respect to the killing, of accidental death, with an expression of sympathy for the owners of the chimney, whose loss was quite heavy.

It is possible that some of our readers may be able to point out the cause of the disaster, and we will therefore give some of the particulars, as deduced from the evidence of scientific experts, workmen, the architect, the builder, and the proprietors.

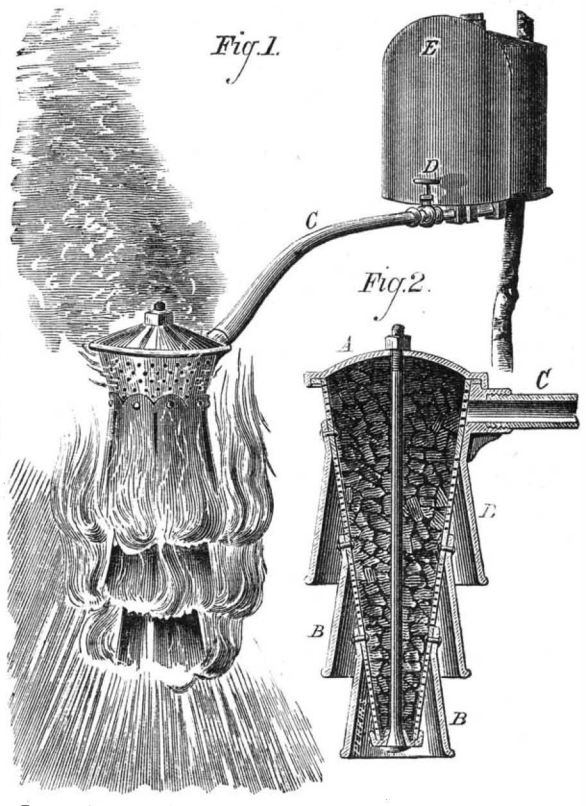
1. The materials were perfect, the workmanship the very best, the method of building excellent; the work was not hurried, more than sufficient time being allowed, namely sixteen weeks, the rate of progress being 14 feet per week.

2. The work was most carefully watched at all times during its progress, and always found plumb; had been plumbed a few minutes previous to the fall, and then stood exactly correct.

3. The walls of the chimney were thicker and stronger than chimneys of equal hight were ordinarily made. The base on which the chimney rested was 30 feet square, base of chimney 22 feet diameter top of chimney 11 feet diameter outside. Thickness of wall at base, 3 feet 9 inches. The first set-off, at 26 feet 3 inches, was 3 feet 4½ inches, at 52 feet 6 inches it was reduced to 3 feet, at 78 feet 9 inches it was reduced to 2 feet 7½ inches, at 105 feet it was reduced to 2 feet 3 inches, at 131 feet 3 inches it was reduced to 1 foot 10½ inches, at 157 feet 6 inches it was reduced to 1 foot 6 inches, at 183 feet 9 inches it was reduced to 14 inches, and it was carried out at 14 inches. A large chimney in West Cumberland, belonging to the West Cumberland Iron and Steel Company, was 250 feet high · diameter of the shaft as it comes out of the ground, 22 feet; thickness about 2½ bricks, which would be about 1 foot 11 inches, so that they were pretty nearly a third thicker at the base; at 160 feet this shaft breaks off to 1½ bricks, that is 14 inches, while at 157 feet theirs was 18 inches. The chimney at Workington was 200 feet; diameter at base 23 feet; thickness of work at bottom, 2½ bricks, that is, 1 foot 11 inches, while they had a thickness of 3 feet 9 inches; at 100 feet, this was 18 inches while theirs was 2 feet 3 inches. The shaft at St. Rollox Chemical Works, Glasgow, was 422 feet from the surface, the thickness at the bottom was 3½ bricks or about 2 feet 8 inches, while this chimney was 3 feet 9 inches, or proportionately nearly double the thickness. The cap was begun about a week before the accident, the greatest projection of the body of the cap was 18½, and it took 10 feet to get out each brick, overlapping barely ½ inch; there were eight projecting ribs in it which projected 4½ beyond, so that it came out a 2 foot projection. They were well supported and not a source of weakness. The weight of the shaft was 1,674 tuns, the weight of the cap being 19 tuns 3 cwt.

BARTHOLOMEW'S IMPROVED TORCH.

Mr. Seth Bartholomew, of Sturgis, Mich., is the inventor of the ingenious form of torch represented in the accompanying engravings. The device may be used for fishing purposes by night, or as a means of illumination during political or other public demonstrations, instead of the ordinary stationary gasoline flambeau generally employed.



It consists of a cast or wrought iron cresset, A, shown in section in Fig. 2, perforated and made in the shape of an inverted cone. This is traversed axially by a rod, the lower end of which forms the bottom of the receptacle, and the upper extremity is screw-threaded in order to hold the nut which secures the cover. Attached and surrounding the cresset is a series of inverted funnels, B. The apparatus is applied and, at the same time, supplied with gasoline or other combustible liquid by a pipe, C, which connects with a suitable can or reservoir. The latter is secured to a post or tree by sockets, and is provided with a screen, E, to protects its contents from the heat of the flame.

The cresset being filled with fragments of brick or other porous material, and the reservoir charged with liquid, the valve, D, is opened. On a match being applied, the finely separated fluid within the cresset takes fire and burns as represented in Fig. 1. Should it be desired to lower or extinguish the light, the operator is enabled to do so by manipulating the cock, D. The brick filling, being wholly noncombustible, will not smolder as a wick would, but will retain its full efficiency for instant service. The funnels may be greater or less in number than represented, and the cresset, if desired, may be otherwise supported and connected with the reservoir by a flexible tube.

Dr. Crace Calvert.

Dr. Crace Calvert died recently at Manchester, England. As an analytical chemist, Dr. Calvert's renown was European. He left England as a youth to pursue his education in France, and in the schools of that country secured many honors—defraying the cost of his education by the awards which he obtained. He subsequently pursued the study of chemistry, and was appointed assistant chemist at the Gobelin Works, under his learned master, Chevreuil. Soon after his return to England, he commenced reading a series of papers before the Society of Arts, on chemistry applied to industry; and on February 12, 1851, brought forward the discoveries of Mons. Chevreuil in relation to the laws of color, his object being to explain upon what basis those laws are fixed, and to point out their application in the effective arrangement of colored fabrics in the Great Exhibition of 1851. In 1846 he settled in Manchester, and was soon after appointed Professor of Chemistry at the Royal Institution there. He was also, for some time, a lecturer at the Manchester School of Medicine. His connection with the Manchester Sanitary Association led him to hygienic investigations—one of the principal results of which was a patent for the application and preparation of carbolic acid. In this he followed up the discoveries of the Prussian, Runge.

Another of his patents was for desulphurizing coke, by means of chloride of sodium, and this has led to an extensive business. In some other directions Dr. Calvert's persistent experiments were doomed to become commercially valueless just at the moment when they had attained to success in the laboratory. This was the case with a patent for sizing cloth, and with another for the production of aniline colors. Dr. Calvert's process for obtaining the aniline from coal tar was soon superseded by its more profitable preparation from benzine. Dr. Calvert made a series of elaborate experiments with picric acid, for dyeing purposes, and also with tannic acid for tanning leather. In scientific circles great interest attached to Dr. Calvert's protoplasmic investigations.—*Journal of the Society of Arts.*

The Hartford Steam Boiler Inspection and Insurance Company.

The Hartford Steam Boiler Inspection and Insurance Company makes the following report of its inspections in the month of September, 1873:

The number of visits made during the month were 1,465; boilers examined, 2,858; internal examination, 792; external, 2,738. The hydraulic pressure was applied in 236 cases. Total number of defects discovered was 1,199, of which 287 were regarded as dangerous. The defects were as follows:

Furnaces out of shape, 46—11 dangerous; fractures, 110—43 dangerous; burned plates, 67—25 dangerous. Several of these cases resulted from the neglect of the fireman to try the gage cocks before starting fire in the morning. The boilers were blown down Saturday night, and then refilled; but the blow-off cock did not close tight, or a defect in the check valve in the feed water pipe allowed the water to run out of the boiler before Monday morning. The red hot, warped and twisted plates soon gave notice of the situation. Blistered plates, 202—28 dangerous; deposit of sediment, 223—27 dangerous; incrustation and scale, 210—24 dangerous; external corrosion, 70—14 dangerous; internal corrosion, 34—14 dangerous; internal grooving, 12—6 dangerous, water gages defective, 79—14 dangerous; blow-out defective, 26—11 dangerous; safety valve overloaded, 43—15 dangerous; pressure gages defective, 189—24 dangerous; errors ranging from —44 to +7 pounds. Boilers without gages, 61—8 dangerous; deficiency of water, 5—3 dangerous; braces and stays broken, 54—19 dangerous; boilers condemned as unsafe to use, 8.

WE are under obligations to correspondents who, from time to time, furnish letters for publication in our columns upon a great variety of practical topics. We highly value these contributions, and hope that our mechanics and others will oftener take the pen and contribute from their valuable store of practical information. During the coming months we hope to enrich our columns with a greater variety of practical subjects, and shall look for an increased number of useful contributions from our readers.

VARIEGATED COTTON THREAD.—Cotton thread may be dyed in two or three colors by covering some parts with parchment paper, tightly wound, and thin tin or lead foil, holding the latter in place by binding threads. If tied sufficiently tight when the skeins are introduced into the dye bath, the protected parts remain white; and by protecting the dyed portion, and unwrapping the white portion, another color may be applied.

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Completion of the Great Bridge across the Niagara River.

The great international bridge across Niagara River from Buffalo to Fort Erie, in Canada, has been lately completed. The Buffalo *Commercial Advertiser* furnishes the following interesting description:

"To state the fact roughly but plainly, the entire length of the bridge is about three quarters of a mile. But more in detail the length is as follows: In the main river, 1,800 feet; over Squaw Island, 1,300 feet (trestle work), and over Black Rock Harbor, 450 feet. The entire length of the superstructure in the main river is 1,890 feet; in Black Rock Harbor, 440 feet. There are nine spans in the portion on the main river and three in the Black Rock Harbor: four of 190 feet in the clear, and three of 240 in the clear. Over the main river also are two draw openings, of 160 feet each; total length of draw girder, 362 feet. In Black Rock Harbor are two draw openings of 90 feet each, and one fixed span 220 feet in length. In the main river are eight piers and two abutments; and in the harbor, two piers and two abutments. The abutments are 40 feet long by 30 wide at the bridge seat level. Over the bridge is laid a track for railroads, and a common sidewalk for foot passengers. The piers and the abutments are built of sandstone from Georgetown and Acton, Canada, and from Berea, near Cleveland, Ohio.

The iron of the superstructure was from the Phœnixville Iron Company's Works, Phœnixville, Pa. The first caisson was launched on the 13th of July, 1870, and work progressed steadily up to the time of completion. It must be remembered that the current of the river, at the point where the bridge is located, runs from five and a half to ten miles an hour, according to the state of the wind. This was throughout one of the greatest difficulties encountered, and frequently retarded progress. Then, too, the depth of water varies from twelve to forty-five feet. The ice in winter, some may think, would damage the bridge in course of time, but the ice breakers afforded ample protection, and cut to pieces blue ice two feet thick with comparative ease. Another remarkable thing connected with the history of the bridge is that, during the whole course of the work, not a single life has been lost. The workmen have, many of them, often been exposed to dangers, but always have escaped.

The respective weights of the different spans over the river are as follows: 190 feet, 130 tuns; 240 feet, 208 tuns; 362 feet draw, 353 tuns; and the entire quantity of iron used in the whole bridge amounts to upward of 2,000 tuns. At the request of Captain Tyler, the English Government Inspector of Railways, who visited the bridge in November, 1871, on behalf of the English shareholders, one of the spans of 190 feet was loaded with 210 tuns of iron rails, equally distributed over the floor beams (a weight greater than that of a continuous train of locomotives covering the span), and left in that condition for three days. This test was highly satisfactory, the deflection being found to be only about one inch, and the truss returning exactly to its former condition on the removal of the load.

The bridge has been leased, to the various railroads which will cross it, for twenty years. The roads are the Grand Trunk, the Great Western, the Canada Southern, the New York Central, the Erie, and the New York, West Shore and Chicago. Most of these railroads have already constructed their approaches to the bridge, and will commence sending trains across at as early a day as possible. The original plan contemplated a carriage way, but this was abandoned for the reasons that, as the bridge was three quarters of a mile long and so many trains were to cross it, there would very seldom be a chance for carriages to cross without interfering with the trains.

The entire cost of the bridge, in round numbers, is not less than $1,500,000. Of its practical benefits we leave the reader to judge, merely stating in conclusion that it supplies a want long felt by the different railroads which have for so many years been obliged to cross the Niagara River on the steamer International.

New Comets.

The present year is marked by the discovery of quite a number of new comets, and the re-observations of others previously noted but since invisible. Particularly is this the case in comparison with 1872, when only one of these vagrant bodies, and that a fragment of Biela's comet, was seen. Up to the current date seven have been observed, which were found as follows: No. 1 on the 3d of April, by Stephan at Marseilles. This comet is identical with No. 2 of 1867, originally discovered by Tempel. The second body is a new one, and of short period, and was noted by Tempel on July 3 at Milan. Another new comet was observed by Breolly at Marseilles on August 20, and a fifth, of considerable brilliancy, passing southwardly, by Paul Henry at Paris, on the 23d of the same month. On September 1, Stephan, of Marseilles, obtained feeble views of Brorsen's, and on the 3d of Faye's, comets. Another new discovery was made on November 10 by Le Verrier at Paris, of a comet which has a slight motion to the southwest, and the last new arrival has been found on November 11 by the Vienna Academy of Sciences.

Professor Kirkwood suggests that persons having the use of comet seekers will do good service to astronomy by searching for these wandering celestials at the present time. It may be added, as an incentive, that the Vienna Academy offers a gold medal for every new discovery.

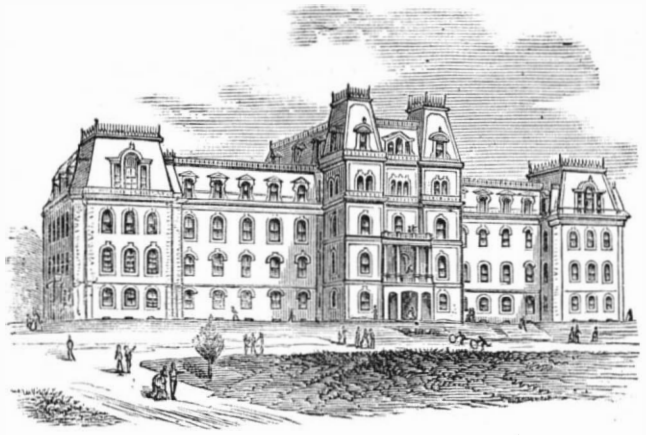
PARDEE HALL AND ITS FOUNDER.

We recently noted the formal donation, by Mr. Ario Pardee, of a large and handsome edifice to Lafayette College, at Easton, Pa. The building, which has been named Pardee Hall, is to be used as the scientific department of the institution. We give herewith an engraving of the structure, and a portrait of its liberal founder. The edifice, to the erection and fitting up of which $250,000 has been devoted, is situated on an elevated knoll in the eastern portion of the college grounds. It has a total frontage of 256 feet, and its main building is five stories high, and extends back for a distance of 61 feet. On each side are lateral wings, 61 feet in length and 31 in width, joining which, at their extremities, are cross wings, 42 feet front by 82 feet in depth.

MR. A. PARDEE, FOUNDER OF PARDEE HALL.

The architectural effect is quite imposing, the handsome mansard roof and two turrets giving a massive appearance to the whole. The material used in construction is Trenton brown stone, with light Ohio sandstone trimmings.

The first floor contains metallurgical lecture rooms and private laboratories, apartments for the study of blowpipe analysis, assaying, ore dressing, and similar branches. Extraordinary facilities are afforded for instruction in the science of mining, there being, among other interesting objects, a complete model of coal mine plant operated by steam, from which the functions of all the different machines and processes can be seen at a glance.



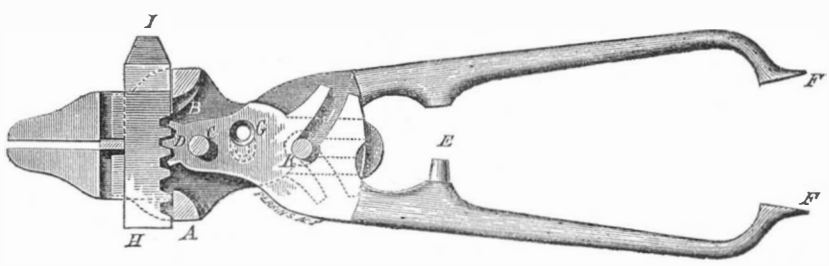
PARDEE HALL, LAFAYETTE COLLEGE, EASTON, PA.

The second story is devoted to geological and mineralogical cabinets, which are arranged to adjoin a spacious lecture hall. Valuable collections of specimens relating to the sciences of mineralogy and geology have been provided, together with necessary apparatus, books, etc. The third floor contains the cabinets and lecture rooms for the classes in the various branches of engineering, and the two upper stories are fitted up with every requisite for the study of chemistry.

The contemplated supply of apparatus has not been placed in the building, so that we shall probably find it necessary to refer in more detail to the various novel instruments and plans in aid of study, at some future time.

WHITEHEAD'S COMBINATION TOOL.

"Very handy to have in the house" is an expression which may be unhesitatingly applied in reference to the useful little invention depicted in our engraving. It is a small tool chest compressed into a single implement which may be readily carried in one's pocket.



There is a double flanged frame or casing, A, which is connected by supports, B. Pivoted at C are the handles which, at their rounded ends, have teeth, D. On a projection on one of the handles is a punch, E, and at their ends are longitudinally projecting pieces, F, the inner extremities of which serve as calipers and the outer ends as the points of a pair of dividers. Both handles are provided with conical holes, G, corresponding to similar apertures in the frame. These are not placed centrally above each other, but some distance to the right and left of the longitudinal axis of the tool, so that the sides of the orifices act, on closing after opening the handles for the admission of a wire, like shears, cutting the same at the point desired. Two straight shanks, H, are wedged transversely into the frame, and slide on the guiding supports. Their lower sides are supplied with a series of teeth which gear into teeth, D. Attached to the shanks, and at right angles, are jaws which act as pliers. One of the shanks is also provided with a steel blade, I, which serves as a screwdriver. The curved slots, J, correspond with longitudinal slots in the frame which guide the connecting bolt, K. The latter is formed in square shape so far as it moves in the lower guide slot, and at its upper end is threaded and provided with a thumbscrew; when the thumbscrew is loose, and the handles are opened and closed, the bolt, K, is caused by the slots, J, to traverse in the longitudinal slots of the frame, and to produce a parallel movement of the jaws and their application as pliers. By tightening the thumbscrew the jaws may be set and used as a hand vise. The tool may be made of malleable iron, steel or any other suitable material.

It was patented June 10, 1873, through the Scientific American Patent Agency, by Mr. H. B. Whitehead, of Holly Springs, Marshall county, Miss.

Ice-Making Machinery at the Vienna Exposition.

The making of ice by artificial means is a matter of rapidly increasing importance, not only on account of the increase it affords in our domestic comforts, but also on account of its usefulness in many manufacturing branches. The ice-making machine has already been of great service in breweries, as it renders the brewer independent of the supply of natural ice, while the ice machine may also be used for the direct cooling of the air and the wort. Besides, ice made artificially by machinery is colder and therefore harder than natural ice, a fact which has clearly been proved by experiments lately made, when equal weights of both artificially and naturally produced ice were placed in warm water of equal temperature, the result being that the artificial ice took more than twice the time for melting that was required by the natural ice.

At Vienna were exhibited three ice-making machines, one by Messrs. Siebe and West, of Lambeth, London, one by Messrs. Vaas and Littman, of Halle on-the-Saale, and a third by the *Actien-Gesellschaft für Fabrication von Eismaschinen*, formerly Oscar Kropff and Co., of Nordhausen, Prussia. The principle applied in Messrs. Siebe and West's machine consists of the production of a cold temperature by means of the evaporation of ether, and of the continued use of the same ether without any significant loss. The machine consists of a refrigerator, a condenser, an air pump, and an icemaking box. The machine works in the following manner: As soon as the air pump is put in motion, the ether in the cooling vessel evaporates, and, of course, absorbs heat from the tubes by which the cooling vessel is traversed. The ether vapor thus produced is forced by the air pump into the condenser, where, under the combined influence of the pressure and the cooling action of the water circulating through the condenser, it resumes the liquid form and returns through a small tube to the refrigerator, in order to be there again changed into gas.

This process is continued with the use of the same ether as long as the machine is kept working. The great cold produced in the cooling vessel acts on the fresh water to be frozen in the ice box by means of a current of salt water introduced into the tubes which pass through. The temperature of the salt water decreases quickly on its way through the refrigerator on account of heat being absorbed from it by the ether changing into gas, and it then circulates, with a temperature considerably below the freezing point in the ice box, round a number of iron or copper vessels filled with the fresh water to be frozen into ice. The salt water, the temperature of which increases again by coming into contact with the vessels containing the fresh water, is taken back to the refrigerator, where its temperature is again reduced. The process of freezing is thus uniform, self-regulating, and uninterrupted, until the fresh water has been changed into ice. The latter is then removed, and the vessels are filled again with fresh water, and are again exposed to the cooling of the brine current. These machines of Messrs. Siebe and West's are now constructed like horizontal steam engines; they are exceedingly simple and compact, and have a steam engine attached, or may be worked from an existing shaft. The ice is made in single cakes, weighing between 8 pounds and 100 pounds, according to the size of the machine. If these cakes are placed one upon the other, they freeze together, so that blocks of any size may be formed. It is stated by Messrs. Siebe and West that they can produce from 10 pounds to 30 pounds of ice with their machines for two cents, and that one pound of coal produces between 3 pounds and 10 pounds of ice. The time taken in removing the ice and refilling the freezing vessels for the next operation occupies from 30 to 60 minutes. Messrs. Siebe and West state further that a temperature of 50 degrees below zero Fah. has been obtained with this apparatus, and that from 50,000 to 500,000 cubic feet of air may be cooled per hour to 30 degrees Fah., or a smaller body of air to a lower temperature. The ice made by this machine at the Vienna Exposition was beautifully clear and

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crystalline, as pure and hard as best American or Norwegian ice.

Examining now the two German ice-making machines, we find that their construction is in nearly every respect identical; and although based on the same thermodynamic principle, these machines differ nevertheless considerably from the English machine, in appearance as well as in working. The English machine appears to us a compact, thoroughly well considered construction, while the German machines show a great number of tubes, and vessels, and cocks, which require a good deal of attention. The general *modus operandi* of the German machines is as follows: A boiler is partly filled with a concentrated solution of hydrochlorate of ammonia, which is heated, and ammoniacal gas is thus generated. This gas is forced through serpentine pipes in a condenser to a refrigerator, and from there it is admitted into the serpentine pipes of the ice box. The ammoniacal gas is exposed on its way to the ice box to a pressure of 8 or 10 atmospheres, while it is considerably cooled in the condenser, the serpentine pipe of which is surrounded by cold water, the results being that the ammoniacal gas becomes condensed to a fluid form. The serpentine pipes of the ice box are surrounded by a solution of hydrochlorate of lime; and the liquefied ammoniacal gas, passing through these pipes, resumes its gaseous form, and absorbs heat from the soluton of hydrochlorate of lime. The boxes with the water to be changed into ice are placed in the ice box, and immersed in the solution of hydrochlorate of lime. The fluid gas evaporated in the serpentine pipes of the ice box passes into an accumulator, where it is absorbed by the fluid freed from ammonia, from which the gas has been produced by heat, this fluid having passed from the boiler through the refrigerator to the accumulator. The fluid is then again forced back by means of a pump into the boiler, whence it passes off again as ammoniacal gas.

These ammonia machines are built in six different sizes, for the production of from 10 pounds to 1,000 pounds of ice per hour, requiring for the same time from 5 to 500 cubic feet of water, and from 5 pounds to 60 pounds of coals. The space occupied by the smallest machines is 6 by 4 feet, and that required for the largest is 45 by 20 feet. The ordinary shape of the ice produced by the machines is a square plate, 2⅜ inches thick, 7¼ inches wide, and 29½ inches long, weighing about 20 pounds.—*Engineering.*

Correspondence.

Hydraulic Mining in California.

To the Editor of the Scientific American:

An article copied from the *Calaveras Chronicle,* appearing in your issue of November 15, is calculated to mislead your readers, as it entirely mistakes the process of hydraulic mining as it was five years ago, or even twelve years ago. No doubt that changes have been made, in that the great power of water has been more universally adopted for mining purposes. I am an old Californian, and will now simply relate a trial that I witnessed in the summer of 1859, in the county of Placer, near Forest Hill, being one of a committee to test the different nozzles, in order to ascertain which among the various constructions would produce the best results in cutting down an embankment.

The water was brought in a flume on the mountain side. The conducting pipe was of iron, 8 inches in diameter, except that, near the lower end where the nozzle was attached, there was about 50 feet of five ply canvas, wound spirally with rope ⅝ of an inch in diameter, all made solid together. The perpendicular pressure was 196 feet; the bore of the nozzles used varied from 1½ to 2 inches in diameter; the nozzles were of various tapers, some being tapered to within a few inches of the end, then going straight; and there were various other forms. The character of earth was cemented gravel, so hard near the bed rock that it was said that a man could not pick up, by hand, four ordinary wheel barrow loads in a day. The embankment worked upon at that time was about 25 feet in depth, but it grew deeper as they worked up into the mountain.

The work of the hydraulic was fearful to behold, and one could scarcely believe one's own eyes. Taking hold of the stream of water as, in its fury, it poured from the nozzle, I could compare it to nothing better than a piece of polished ivory; and it could not be penetrated with the finger. I tried to split the stream with my pocket knife blade, by holding the edge against the nozzle at the end, but could not hold the knife sufficiently firmly to do it. The operator stood about 22 feet from the embankment, the water pouring with terrific fury into the bank, roaring, clashing, and filling the air with stones, the gravel flying in every direction. The stump of an oak, newly cut, about 18 inches in diameter, stood near the edge of the embankment, with a few roots hanging over. The operator requested us to mark the time required to wash it from the bank clear; in less than 20 minutes it was undermined and rolled down hill, and every root was washed clean. As an experiment, the bark was peeled from a green oak, 20 feet distant, by the furious water. When the top dirt was washed off, down to within a foot or so of the bed rock, the operator directed the stream under the lower edge and raised large flakes (or lifters, as he called them) hurling them over and over, breaking them up among the rocks, and sending them into the long sluice, where (with rocks, some weighing more than a tun) they went thundering down for near half a mile in length, where most of them were ground up, leaving the bewitching contents at the bottom of the sluice.

Directing the stream against the side of large boulders, which four men could not have turned over by hand, they were easily rolled over and over by the force of the stream. The nozzle which carried off the prize was some 6 inches at the large end, where the water entered, and I think 1¾ inches at the discharge end; it was very long (7 or 8 feet) and a portion of the small end bored out perfectly smooth to an exact focus of 22 feet, being the distance from the bank at which it was most commonly used. If used at a sharper focus, the currents seemed to cross each other and confuse or scatter the stream beyond; with a portion of the end bored straight, the stream seemed to scatter from the point of discharge. As the washed rocks occasionally accumulated on the washed bed rock below the embankment, impeding the course of the dirt to the mouth of the sluice, the operator would (with a kind of sweeping stroke) direct the stream so as to sweep everything before it, often shoving ten cart loads or more at a single sweep over the bank into the sluice.

Even before this time, I had seen hydraulic mining (at Alpha and Omega, and at Nevada, as well as in other localities) of which, even in this day of improvements, California need not be ashamed; it leveled the mountains and often buried men alive. J. E. EMERSON.

Beaver Falls, Pa.

Petroleum as Fuel.

To the Editor of the Scientific American:

A series of trials have been made here recently, on a small scale, to determine what may be done with petroleum as a fuel under steam boilers. The boiler used was an ordinary eight horse upright one, about three feet diameter and six feet high, with the usual number of one and a half or two inch vertical flues, the lower flue sheet being about fourteen inches from the grate. The device for burning the petroleum was placed upon the grate, and a stream of oil, scarcely larger than a No. 16 wire or the rapid dropping of the oil (about six quarts an hour), mingled with a certain quantity of air under pressure, was sufficient to raise steam to thirty pounds to the inch in thirty-five minutes. Considering that during this time the furnace door was kept wide open for the purpose of observation, and that the boiler was in a cold room and entirely unprotected by jacket, I think this may be regarded as a good result.

It seems to be requisite that the air should have considerable tension, and mingle with the burning oil in jets, and in quantity proportionate to the quantity of oil, in order to ensure perfect combustion; for it was noticed that, while the apparatus was being adjusted, considerable smoke occasionally arose; but as soon as proper adjustment was reached and the boiler and apparatus had warmed up, the consumption was quite free from smoke and gas.

Although these tests (some half dozen in number) have been upon a small scale, consuming only about one barrel of oil, all told, they certainly indicate that petroleum has the qualities of a strong and economical fuel.

Worcester, Mass., Nov. 6, 1873. F. G. WOODWARD.

Tracks in the Solid Sandstone.

To the Editor of the Scientific American:

Having heard that there were numerous mule, deer and turkey tracks to be seen on a ledge of rocks, situated about four miles northeast of this place, on the farm of Mr. John Stevenson, I visited, in company with Mr. Louis Graff of this place, and made a thorough investigation of the surface of the spot. We found that the rocks, which are a very hard sandstone, extended thickly over several acres of ground. The top surface of almost every loose rock was marked plainly with tracks like those of small mules of various sizes; some few were not over an inch in diameter. We found one very distinct track, showing the hollow of the hoof, and of the size and exactly like that of a common sized horse. We found a few tracks like those of deer, some such as a deer makes when leaping, others made as when walking. Several tracks were made in slipping; some shewed notches, as made by the notched hoofs of the wild horses on the western plains. We found, where the unbroken stratum had been exposed by the washing of the rains, that its surface was also covered with the same kind of tracks as those on the loose rocks.

We were informed that many rocks had been hauled away as curiosities; and that there used to be found on the rocks distinct turkey tracks, and perhaps the tracks of other kinds of birds. A. M. BOURLAND, M. D.

Van Buren, Crawford county, Arkansas.

Railway Religion.

To the Editor of the Scientific American:

Many an attentive reader of your valuable paper has been pained to read an article under the above caption, on page 297 of your current volume. Knowing your reputation for fairness, I had rather believe that the article spoken of found its way into your columns by accident than by design. There may be some "divines" who believe that "the world was made in a week," but they are not the index of the Christian ministry of today. Clergyman are not of all men most ignorant; and they that are not altogether unacquainted with the modern developments of science is clearly proved by the fact that not a small number of them are among the readers of the SCIENTIFIC AMERICAN. We have searched in vain among the utterances of the late Evangelical Alliance to find one which came anywhere near calling scientific men "servants of the evil one, infidels, and scoffers." Yet it is taken for granted that the delegates will do so from their pulpits on the first suitable occasion.

There can be no real controversy between science and religion. Fanaticism and ignorance may get into collision, but the intelligent clergyman is just as apt to adopt the teachings of pure science as the scientist is to respect the claims of religion. JAMES PITCHER, Principal.

Hartwick Seminary, N. Y.

LABORATORY NOTES.

BY S. P. SHARPLES.

ELECTROTYPING WITH IRON.

M. Klein, a Russian chemist, has succeeded in electrotyping with iron. He used a bath consisting of a concentrated solution of sulphate of iron and ammonia, and four Meidinger cells. For an anode he used an iron plate having a surface about eight times that of the cathode, and connecting this also with a copper plate. He found by this means he could get a perfect coating of iron. On leaving the bath, the iron is as hard as tempered steel and very brittle; heated to a cherry red, it becomes malleable, and may be engraved as easily as soft steel.

CEMENT FOR PIPES, STILLS, RETORTS, ETC.

J. Spiller recommends a mixture of pulverized iron borings, kaolin, and sirupy silicate of soda as a lute for fixing on the heads of stills which are required to stand a high temperature. We should judge the same might be found useful in other situations, such as the joints of cast iron furnaces, for instance.

PRESERVING GELATIN SOLUTIONS.

Lanjorroic finds that the addition of 1 per cent of fuchsin to a solution of gelatin will prevent its putrefaction. A quantity prepared in this manner was kept 11 months without change. The addition of a very minute quantity of aniline violet to gelatin or to an infusion of coffee was also found to prevent its putrefaction entirely. It is hard to understand how these substances do this, if they have no poisonous properties.

COPYING MEDALS.

Copies of medals or other similar articles may be readily made by a very simple piece of apparatus. A cast of the medal is first taken in wax. This is done by moistening the medal or coin slightly, and then pouring the melted wax over it. The object of the moistening is to prevent the wax sticking to the surface of the metal. While the wax is still warm, a piece of copper wire should be imbedded in it to serve as a support, and to connect with the zinc in the decomposing cell. After removing the medal from the mold, the surface of the mold is dusted over with fine plumbago until it appears quite black; all excess of the carbon is then carefully removed with a soft brush. If fine iron filings can be had, a few of them are sifted over the face of the mold, and a solution of sulphate of copper is poured on it. It is then carefully washed; this serves to give a very thin coating of copper, and facilitates further operations, but may be omitted if not convenient. Care must be taken, in putting on the plumbago coating, that it comes in contact with the copper wire. A very convenient way of applying this wire is to bend it into a ring slightly larger than the medal to be copied, lay it on the table around the medal, and pour the wax over both at the same time. Scraping with a knife exposes it completely. The mold being prepared, take an ordinary glazed earthenware basin four or five inches deep, and in it set a small flower pot, having previously plugged up the hole in the bottom of the pot with a piece of wood, a little wax, or other suitable material. The flower pot is to be filled with a weak solution of common salt. The outer basin is then filled with a strong solution of sulphate of copper, and a little bag holding crystals of sulphate of copper is hung in it to keep it saturated. Add a few drops of sulphuric acid to both solutions, place a piece of zinc in the flower pot, and connect it with the wire of the mold. The mold being now put in the outer solution, a coating of copper soon shows itself. The mold may be left in the solution two or three days, if a thick coating is desired.—*Boston Journal of Chemistry.*

Trees as Historians of the Past.

M. Charles Gros has recently communicated a note to the French Academy of Sciences on the study of the yearly rings, shown when the trunk of a tree is transversely divided. These layers by which, as is well known, the age of the tree may be determined, do not diminish in relative thickness by a constant law. In view of this, M. Gros seeks a cause for the irregularity, and, it seems, has arrived at the conclusion that the data, mean and extreme, of meteorological phenomena, when known and tabulated, might be compared year by year with the annual ligneous layers formed during such periods in many different varieties of trees.

From the comparison it is not impossible that some interesting ideas relative to the laws of development of trees may be obtained. But, moreover, these laws once established, the trees in their turn might become precious collections of meteorological evidence for places and times where observations cannot be made. *Les Mondes* suggests rather a striking example of what might be learned from ancient trees, as follows: "Suppose that there should be found in Egypt a very old though living tree, the origin of which dated back to the time of Joseph. If, on cutting the trunk, the rings corresponding to that period showed seven thick and seven thin layers, there would be tangible evidence of the truth of the Scriptural tradition of the seven years of plenty and seven years of famine, besides of the immediate causes of humidity, temperature, etc., to which such phenomena might be due."

DRIER FOR OIL COLORS AND VARNISHES.—Water, 100 parts; gum lac, 12 parts; borax, 4 parts.

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PRIZES FOR IMPROVEMENTS.

The Society of Arts, London, has lately issued a detailed statement of prizes offered for various practical improvements. We present the list, believing that, if our readers may not wish to compete, it will be suggestive of subjects for invention, and lead to new discoveries in other matters, if not in those here mentioned. We have recently published a list of five other rewards offered, for improvements pertaining to the use of gas, by the same Society, which it is unnecessary here to repeat.

The Council, in issuing this list of subjects and asking for communications upon them, state that they are aware that some of the suggestions put forth may, at first sight, appear difficult of realization. In some instances, the thing sought involves the use of known substances in the industrial arts in a manner in which they are not at present employed, but in which there is reason to believe they are capable of being used with economy. In other cases the aid of the chemist is sought to develope such a form of action upon the material used as will induce the creation of new industries, or aid the extension of old ones by economizing processes, render them less detrimental to health, or lessen the risk of accident to those employed.

Steam is the motive power now generally employed, but its use on common roads seems at present, for various reasons, inadmissible. Other agents, such as mercury, gunpowder, and petroleum, have been tried, but hitherto without success. There are, however, many other materials in Nature to which scientific men and others may well turn their attention for the development of power, and put them in a form which shall render them available to the engineer and mechanist. It is believed that not one of the objects here sought is incapable of realization; and the Council hope that men of science—engineers, manufacturers, colonists, and agriculturists—will combine with men of capital to realize and bring many of them into commercial use.

$1,000.—SWINEY PRIZE.—JURISPRUDENCE: Under the will of Dr. Swiney, a silver goblet, of the value of $500, containing gold coin to the same amount, is presented on every fifth anniversary of Dr. Swiney's death "to the author of the best published treatise on jurisprudence." The next award of this prize will be made on the 20th of January, 1874. Competitors for this prize should send in copies of their published works to the secretary not later than December, 1873.

$500.—TREVELYAN PRIZE.—PRESERVED FRESH MEAT: The sum of $500, placed at the disposal of the Council by Sir W. C. Trevelyan, Bart., with the Society's medal, is offered for the discovery of a process for preserving fresh meat in an uncooked or raw state better than by any method hitherto employed, applicable to the preservation of meat in countries where it is now almost valueless, so as to render it an article of commerce.

FOTHERGILL PRIZE.—Under the will of Dr. Fothergill, funds are bequeathed for the offer of a medal, and "the following subjects are proposed to the Society for their consideration: (1.) The best method of preventing destructive fires, and of detecting incendiaries. (2.) Of speedily extinguishing fires when water is scarce. (3.) Of speedily securing valuable property from the flames, and also from thieves. (4.) Of preventing or diminishing the numerous fatal disasters from fashionable muslin dresses catching fire, whether by rendering such dresses less combustible, or having constantly in readiness a large cloak of incombustible fabric, composed of asbestos or amianthus, with which instantly to enwrap the whole body. Paper of this kind (incombustible) might preserve from fire valuable deeds and other manuscripts. A premium for the encouragement of such a manufacture is also recommended. The above to be varied at the Society's discretion." On the present occasion the Society's medal is offered as follows:

GOLD MEDAL.—UNINFLAMMABLE WOOD: For the economic production of an uninflammable wood, so as to render buildings in which it is employed less destructible by fire.

HOWARD'S PRIZE.—GOLD MEDAL OR $125: For the production of a traction engine of moderate power, capable of being employed as a substitute for horse power on tramways and in the streets of cities and towns. The engine to form one structure in combination with the tramway carriage. The power may be generated by any means, provided that noise, noxious fumes, and the discharge of refuse into the air or on to the road surfaces are avoided.

GOLD MEDAL.—For the discovery or manufacture of a means for safely and economically generating power, suitable for use in place of steam. It should be free from refuse, noxious fumes, and injurious effects on the metals with which it may be brought into contact, or on the workmen employed.

SILVER MEDAL OR STOCK PRIZE.—Under the will of John Stock, funds are bequeathed for the offer of a medal for the encouragement of drawing, sculpture, and architecture. SHELL CAMEOS.—On the present occasion the Society's medal is offered to female artists, for the best cameo, designed and executed on any of the shells ordinarily used for that purpose.

GENERAL PRIZES—GOLD AND SILVER MEDALS.

MOLDS FOR METAL CASTING.—For the production of molds for casting, constructed without seams, and capable of resisting the temperature employed in running bronze and other molten metals; specimens of the molds and casts to be sent to the Society.

COATING VESSELS.—For an economical method of coating large vessels of zinc, such as baths, so as to present a bright and clean surface, not readily oxidized and as durable as a tinned or japanned surface.

VACUUM.—For the introduction and use of a vacuum, for the drying and preservation of fruits and vegetables, either with or without heat of low temperature.

VACUUM.—For any new and economic application of a vacuum in the preparation or finish of manufactured goods.

ELASTIC TUBING.—For an elastic material for tubing suited to the conveyance of gas, and not liable to be affected by moisture, alterations in temperature, or to be acted upon by the gas itself.

ROLLERS FOR PRINTING.—For a composition for feeding rollers for printing by cylinder machinery, similar in consistency and texture to the gelatin rollers used in letterpress printing, but adapted for working in water colors.

IMPROVED CHEMICAL BALANCE.—For the best chemical and assay balance, suitable for the use of students and experimentalists, which (loaded with 600 grains in each pan) will show a difference of ·005 or less. To be sold at a moderate price.

INCOMBUSTIBLE WICK.—For the production of an incombustible wick, suitable for use in lamps.

CASTS (WHITE MARBLE).—For a means of casting ornamental panels, or marble groups of figures, flowers, etc., in white marble, so as to retain the transparency of the marble itself, as well as the polished surfaces of artistically finished works.

WASTE COAL.—For a more economical and efficient method than any at present in use of preparing waste coal, so as to render it available as fuel for engineering or domestic purposes.

COAL WORKING MACHINERY.—For an account of the modes at present in use for getting coal, and suggestions for improvements calculated to render the use of machinery more general in coal mines.

LIGHTING COAL MINES.—For a means of lighting coal mines, so as to increase the light in the workings, and at the same time reduce the risks arising in the use of the ordinary miner's lamp.

TUNNELING.—For the best account of the machinery used in tunneling, with suggestions as to the best means of applying either compressed air or water power in the working or getting of minerals.

FREEZING MACHINE.—For a machine or process, either chemical or mechanical, for lowering the temperature of substances by the abstraction of heat, more effectually and at a less cost than is done by machines at present in use. The machine must be capable of working efficiently in the tropics.

ETCHING AND ORNAMENTING IRON.—In a permanent way by the use of chemical agents; or by the application of enamels; or by both conjointly, for the decorations of iron fire grates, fenders, gaseliers, etc.

FOR THE APPLICATION OF LITHOGRAPHY OR BLOCK PRINTING.—To stopping grounds, for etching upon glass or metals by means of chemical agents.

A VARNISH—or coating which can be applied to iron wires, so as to protect them against rust, and which shall not be liable to chip off when the wire is bent or rubbed.

A GALVANIC ELEMENT—which shall combine the constancy of the Daniell's cell with the low resistance and high electromotive force of a Grove's cell.

AN ELECTRIC CONDENSER—which shall combine high capacity with small bulk and small residual charge.

A SENSITIVE POCKET GALVANOMETER.—The size should not exceed that of a watch.

POTATO DISEASE.—For a method of preventing the potato disease.

NEW EDIBLE ROOTS.—For the discovery and successful introduction into England of any new edible root or tuber useful as food for men or cattle, capable of resisting frost, and suitable for extensive and improved cultivation.

HYDRAULIC ENGINE.—For a small, simple, cheap, and effective hydraulic engine, which, in connection with the constant water supply of towns, can be applied to work lifts in warehouses, drive lathes, the bellows of organs, etc.

UNSINKABLE SHIPS.—For plans for the construction of an efficient and seaworthy vessel, such that, when perforated either by shot or accident and filled with water, she shall in part maintain her floating power.

DIVING APPARATUS.—For an improved diving apparatus, in which divers may work free from the inconvenience of great pressure, and at greater depths than by means of the diving bell, helmet, or other existing appliances.

ELECTRIC WEAVING.—To the manufacturer who first practically applies electricity to the production commercially of figured fabrics in the loom.

NEW GUMS OR OILS.—For any new resin, gum, or oils, the produce of India or Africa, calculated to be useful in the arts and manufactures, and obtainable in quantity at a moderate price. Samples of not less than 25 lbs. of gum, and 50 lbs. of oil, to be transmitted to the Society.

MINES.—For the best method of applying air or water as a traction power in mines.

TELEGRAPHS.—For an economic and permanent means of telegraphing through uninsulated wires, between places not less than 1,000 miles apart.

COLONIAL SILK.—For the importation of silk cocoons, the production of any of the Australian colonies, in a dried and preserved state, in bulk, and fit for silk-reeling in England.

SURFACE BLOCKS.—For a ready means of reproducing designs by artists, as surface blocks, possessing sufficient relief to admit of their being worked at the steam press sharply and without blur.

GUNPOWDER.—For a method of constructing magazines for the storing of gunpowder, gun cotton, nitro glycerin, and other highly explosive compounds, so as to give increased security against explosions, and more effectually to provide against the possibility of large masses of material exploding, or, in case of explosion, communicating with other and adjacent quantities of explosive material.

PETROLEUM AND OTHER LIGHT OILS AND SPIRITS.—For a cheap and effective method of constructing storehouses for the stowage of petroleum and other light oils in towns and cities, so as to give greater security to the adjacent properties.

PEAT.—For the introduction into commerce, as a substitute for coal, of fuel manufactured from peat, and suitable for combustion in domestic fireplaces, the furnaces of steam engines, and for industrial purposes generally.

Patented inventions are not excluded from receiving the Society's rewards. The Council reserve to themselves the right of withholding all or any of the above medals or premiums, as the judges may report. The Council is willing to receive communications on subjects not included in the above list. The degree of originality and value of suggested improvements will have material influence on the adjudication of the award. In all cases a full account and description of the invention for which a medal or premium is sought must be sent to the Society. All communications must be written on foolscap paper, on one side only, with an inch and a quarter margin. They must be accompanied by such drawings, models, or specimens, as may be necessary to illustrate the subject. The drawings should be on a sufficiently large scale to be seen from a distance when suspended on the walls of a meeting room.

With regard to colonial produce of all kinds, it is absolutely necessary that a certificate from the Governor, Collector of Customs, or other qualified person, should accompany the samples sent to the Society, certifying that they really are the produce of the particular district referred to. The samples should be sufficient in quantity to enable experiments to be made and an opinion to be formed of their quality and uses; and it is desirable that the cost price in the district from which they are forwarded should be given. In every instance the probable extent of supply, with the average yield, if cultivated, and whether similar articles have hitherto been exported from the colony or not, and in what quantities, should be stated.

All communications and articles intended for competition must be delivered, addressed to the secretary, at the Society's House, London, free of expense, on or before the 31st of December, 1873 or 1874. In the first case they will be considered during the session 1873–4; in the second case, during the session 1874–5.

Any communication rewarded by the Society, or any paper read at an ordinary meeting, will be considered as the property of the Society. Should the Council delay the publication beyond twelve months after the date of its being rewarded or read, the author will be permitted to take a copy of the same, and to publish it in any way he sees fit.

Zinc Bandages in Surgery.

An interesting and important experiment in surgery was performed at the Park Hospital, a few days ago, in the presence of a number of distinguished surgeons, by Dr. Fluhrer, inventor of a new bandage for fractured limbs. The contrivance consists of a number of perforated zinc strips, which, when once arranged, form an absolutely inflexible bandage, not to be disarranged by any violence or uneasiness of the patient. As soon as these cover the point of fracture, the limb is firmly set and the natural outline restored. In one of the wards of the Park Hospital is Francis Lefry, a truckman, who had a compound fracture of both thighs. No parallel case of dual fracture, it is said, is on medical record; and, as the most unpromising, the doctor selected it for a practical test. After ether had been given to the patient, Dr. Fluhrer bent over the sole of each foot a broad zinc strip in the form of a loop, the extremities of which were securely wrapped with cloth bandages previously steeped in plaster of Paris, which were prevented from slipping by the tooth-like projections of the reverse side of the punctured zinc. The terrible fracture of both thighs, when the limbs were stripped for this purpose, could be plainly perceived. To the loops were fastened stout cords, which passed over the grooves of pulleys affixed to the adjacent wall, and were drawn taut by Warden Brennan. Dr. Fluhrer next mummified the limbs with a multiplicity of bandages, over which he laid his zinc strips, and covered them with a second stratum of bandage. Immediately the lumpiness about the region of injury disappeared, and the doctor expects that, in six weeks, this bandage will be removed, and in two more Lefry will use his legs.

Two New Steamships.

Two new steamers have recently been completed at the ship yards at Wilmington, Del., belonging, respectively, to the Cromwell and Metropolitan lines, and named the Knickerbocker and General Whitney. The former vessel is of iron, of 2,000 tuns register, 280 feet long, 34 feet beam, and 23 feet depth of hold, costing $260,000. She has a vertical inverted condensing engine 44×72, and four tubular boilers. With steam up in only two of the latter, it is stated, the ship easily made a speed of 10 knots per hour. She will ply between this city and New Orleans.

The General Whitney is also of iron, and is besides a very fine model of marine architecture. Her length is 245 feet, beam 40 feet, hold 28 feet and tunnage 1,848. There are two inverted engines 36 × 60 and three cylinder furnaces to each boiler. The engines and boilers are carefully enclosed in iron, and the engine room is remarkably commodious and well lighted. The vessel has some novel arrangements in the shape of four independent hoisting engines, operating seven freight cranes stationed at various points. By this means the time consumed in receiving or discharging cargo will be materially reduced. The port shutters are also of new invention, and are easily worked by one man, though of exceptionally ponderous construction. The ship will be used, for freight purposes only, between this city and Boston.

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IMPROVED TURBINE WHEEL GOVERNOR.

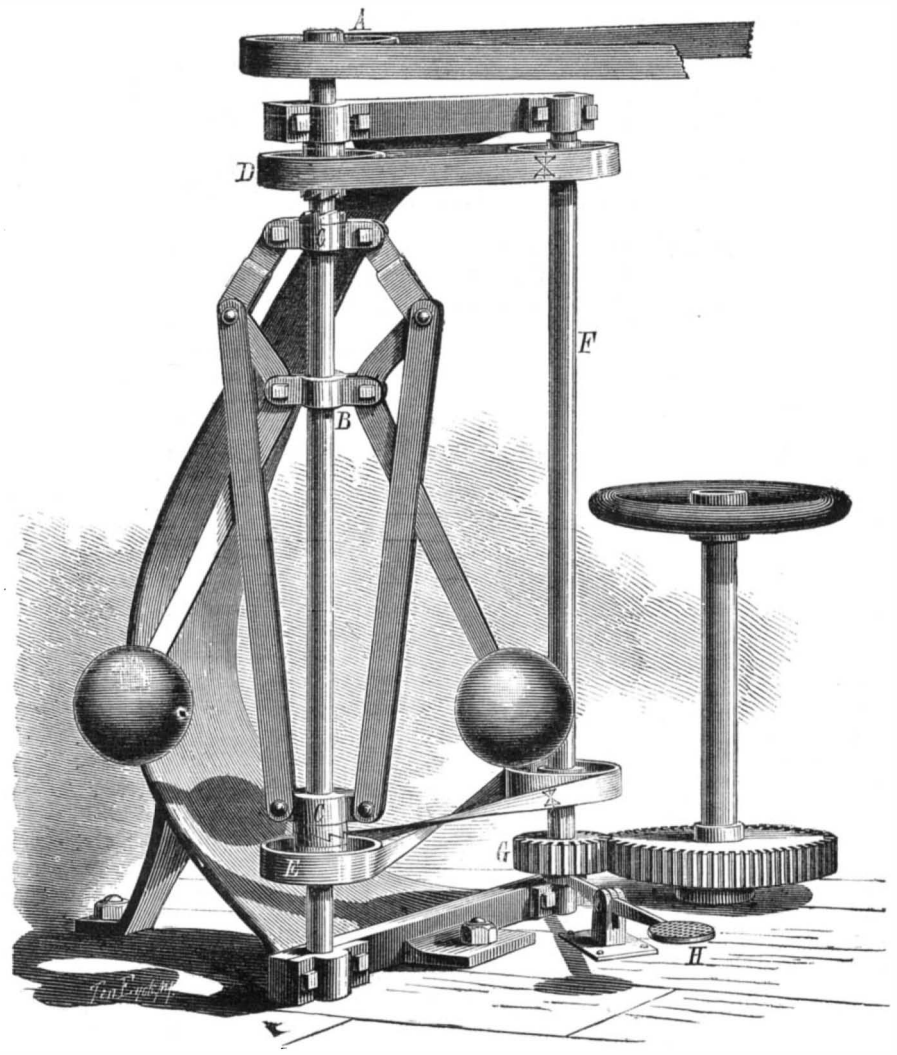
We illustrate herewith a novel and simple form of apparatus which, it is claimed, acts as an efficient and reliable governor for turbine or other water wheels. The construction is of a type generally familiar, the balls being thrown out by the centrifugal force of the rapid rotation, which of course increases with the speed, thus, through suitable apparatus, controlling the gate, and hence the quantity of water which reaches the buckets of the wheel.

A is the driving band and pulley by which motion is given to the governor shaft. Pivoted to lugs immovably secured to the latter, at B, are the bent levers, which terminate in the balls as shown. These communicate with other pivoted rods, the connection between which is clearly indicated in the engraving, and which finally connect above and below with sleeves, C, which slide freely up and down the governor shaft. To the sleeves are secured portions of clutches, the corresponding parts of the latter being attached to two loose pulleys, D and E. Pulley D connects with another pulley on a second shaft, F, by means of a straight belt. Pulley E, however, is attached to the same by a crossed band. Consequently the effect is that, when the pulley, D, is in action, the shaft, F, rotates in the contrary direction to that which it assumes when the pulley, E, is in operation. Shaft F has a pinion, G, on its lower end, which pinion communicates with a gear wheel on the gate shaft.

The operation of the device can now be easily followed. The turbine is started by opening the gate by turning the large hand wheel shown on the shaft. To do this the pinion, G, which is connected with the shaft, F, by a slot and feather, is lifted by the foot lever, H, so that its teeth no longer engage with those of the gear wheel. As soon as the turbine is in motion, however, the pinion is allowed to fall back into place. The pulley, A, rotating the governor shaft, transmits motion to the balls through the rigid connection of their arms at the point, B. It is evident that, as the rapidity of motion increases, the balls will assume a position more nearly perpendicular to the vertical shaft, and in so doing will raise the upper sleeve so that the clutch upon it and the pulley, D, engage, causing the pulley to be carried around. By this means the shaft, F, and pinion, G, will be rotated so as to turn the gate shaft and partially close the gate, thus checking the inflow of water.

The speed of the wheel will, of course, diminish, when the balls will fall and the clutch above drop out of action. In case the speed should become too slow, then the further effort of the balls to reach the lowest possible point will cause the lower clutch to come into action with the pulley, E. This, however, as we have already explained, causes the shaft, F, to turn in the opposite direction, opening the gate wider and increasing the speed. It is evident that the supply of power will be so adjusted as to develope a speed of shaft that will keep the governor arms and balls between the two clutches, for, as a matter of course, the moment either clutch comes into action, the effect is either to increase or diminish the speed until the apparatus resumes its proper position.

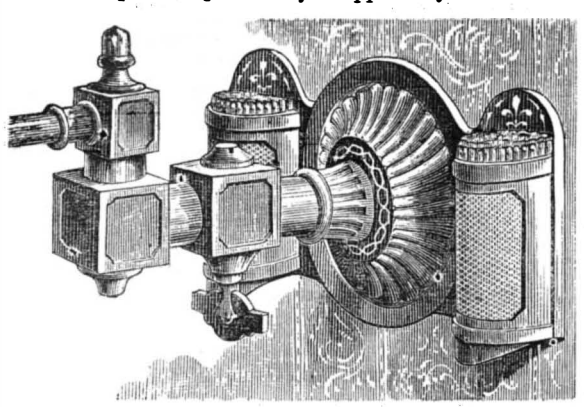
For further particulars address the inventor, Mr. Joseph F. Terhune, Stockholm, N. J.



TERHUNE'S TURBINE WHEEL GOVERNOR.

GAS BRACKET MATCH SAFE.

Everybody has experienced the annoyance of searching for matches in a dark room, doubtless to the no small detriment of temper as well as of such projecting portions of the body as are brought in sudden contact with vagrant rockers or sharp corners of tables and bureaus. Match safes, in fact, have the unpleasant peculiarity of apparently never remaining in the spot where last placed, because every one using the contents leaves the box wherever about the room he may happen to be, so that the next person is obliged to hunt for it. Moreover, about nine tenths of the common match receptacles upset on the slightest provocation, strewing the floor with inflammable material, ready to take fire and burn holes in the carpet, and sometimes set dresses on fire, whenever accidentally stepped upon. We illustrate herewith a new form of safe, the invention of Mr. M. L. Orum, which can neither upset nor wander about a room, because it is fastened immovably to the wall by screwing the gas bracket against it. The fixture is first removed, the hole in the device slipped over the pipe, and the bracket replaced, the whole being the work of a moment. Thus located, the box is always at hand when and where wanted, and, besides, is situated at the point where matches are usually scraped upon the wall, thus preventing injury to the paper or paint. It can be made with either one or two receptacles for matches, two being preferable, as one of the boxes may be employed to receive the burnt sticks. In material, style, and design, the attachment may correspond to the bracket to which it is screwed.



For hotels, where lodgers are apt to carry off the match boxes, the invention is excellently adapted, while its convenient and ornamental form will doubtless commend it as a necessary appendage to the gas fixture in every room.

For further particulars regarding rights to manufacture, application should be made to Messrs. Mellor & Orum, 448 North 12th street, Philadelphia, Pa.

The Opeioscope.

This is a new and simple instrument, suggested by Professor A. E. Dolbear, for the purpose of demonstrating the pulsations of sound. Take a tube of any material, from one to two inches in diameter, and anywhere from two inches to a foot or more in length. Over one end paste a piece of tissue paper or a thin piece of rubber or goldbeater's skin; either will do. In the center of the membrane, with a drop of mucilage, fasten a bit of looking glass not more than an eighth of an inch square, with the reflecting side outward, of course. When dry, take it to the sunshine, and, with the open end of the tube at the mouth, hold the other end so that the beam of reflected light will fall upon the white wall or a sheet of paper held in the hand. Now speak, or sing, or toot in it. The regular movement of the beam of light with the persistence of vision presents very beautiful and regular patterns, that differ for each different pitch and intensity, but are quite uniform for given conditions. If a tune like "Auld Lang Syne" is tooted slowly in it, care being taken to give the sounds the same intensity, a series of curves will appear, one for each sound and alike for a given sound, whether reached by ascension or descension, so that it would be possible to indicate the tune by the curves; in other words, it is a true phonautograph.

By trial one can find some tone which causes the membrane to vibrate in a single plane, and of course a straight line will appear upon the screen. If, while the sound is continued, the tube be swung back and forth at right angles to the line, the sinuous line will appear, which may be either simple, representing a pure and simple sound, or it may be compound sinuous, showing over tones, precisely as in König's manometric flames.

With the lecture room darkened and using the beam of light from a *porte lumière* or from a lantern, these may be projected of an immense size. There is no trouble in the world in making them eight or ten feet amplitude or more if needed. At a distance of but three or four feet, the curves will spread out to two or three feet in length when a tone is made to which the tube can reasonably respond.

The Water Supply of Rome.

In the course of a lecture on Roman antiquities, delivered at the Royal Institution, London, Mr. J. H. Parker said: The celebrated *Aqua Marcia* has recently been again brought into Rome, and is rapidly coming into use, being considered the finest drinking water in the world, always cool even in the hottest weather. On the river Anio itself, where a fine cascade falls over the rock, there is a deep rocky gorge; and here great engineering works were made in the time of Claudius and Nero. A great wall, 12 feet thick, built of large blocks of stone, was erected across the river at the lower part of the gorge, forming a dam of 100 feet high and 12 feet thick, to enclose a portion, perhaps 100 yards long, between the dam and the natural cascade; the water was made to fall over the dam, which thus became the cascade; but at one end of it a specus was made below the level of the surface of the water, so that the water must always flow through that specus, and consequently through Rome, before any of it could fall over the cascade. This magnificent and most useful piece of engineering continued in use for centuries. It was destroyed in the fourteenth century by an ignorant monk, who was annoyed by a temporary flood in the upper country, which overflowed the meadows near his monastery, and, to relieve that, he made a hole at the bottom of the great dam. The force of the water soon carried all before it, and caused a great flood over all the lower country, even to the Tiber, and did immense mischief—even the walls of Rome were injured.

Mr. Parker said that he had not time to describe the thermæ, or great public baths, to supply which most of the aqueducts were made, but he could not conclude without mentioning that the opinion, commonly entertained, that the ancient Romans were ignorant of the fact that water will rise to its level, is entirely a popular delusion. At every half mile of the aqueducts, on their course from the foot of the hills to Rome, each aqueduct forms an angle, to break the force of the water, and at that angle a great reservoir is made, with a piscina or filtering place at one end. Each piscina consists of four vaulted chambers, two above and two below. The water enters into the top of the first upper chamber; it then falls through a hole in the vault into the first lower chamber, then passes through small holes in the intermediate wall into the second lower chamber, then rises again through a hole in the vault into the second upper chamber, and then follows its course at the same level as it originally entered, depositing its mud in the lower chamber as it passed. Each piscina is therefore made upon the principle of water finding its level.

They used the large stone specus, or aqueducts, instead of ordinary pipes, because they could not depend either upon their leaden pipes or their *terra cotta* pipes to resist the force of such a stream of water. Nothing but the concrete stone was strong enough.

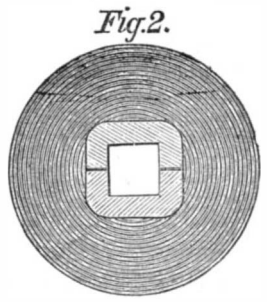
At the present time, the cast iron pipes of the new company are bursting every day in the streets of Rome to such an extent that the managers of the company fear that the expense will be ruinous to them. This seems to show that the old Romans were better engineers than we are.

A Trade Mark Decision.

The value of trade mark security to manufacturers and merchants is forcibly demonstrated in the following recent decision of the Supreme Court, rendered in the Circuit Court of the United States for the Eastern district of Pennsylvania, McKenna, judge, in the case of the Lowell Manufacturing Company against Larned and Starr, which is of interest as bearing on the law of trade marks. The complainants many years ago began to send their rolls of carpet to market with a hollow wooden shell in the center of each roll. The annexed engraving exhibits the construction. Fig. 1 is a plan view of the inside half of the shell. Fig. 2 is an end view of carpet, rolled, with shell in place. This shell can both be seen and felt. Becoming a distinguishing mark of the goods, they continued its use and adopted it as their trade mark, registering it as such in January, 1871, under the act of July 8, 1870. Defendants copied it, and complainants having brought suit, pleaded that it was an unpatented mechanical contrivance for rolling the carpet and extracting the spindle. After full argument by Horace Barnard and Ludovic C. Cleeman for complainants, and Victor Guillon for defendants, Judge McKenna decided that the "shell" is a good and valid trade mark, and complainants are entitled to its exclusive use, further deciding that defendants have infringed. A perpetual injunction is granted, with reference to a master to compute and assess profits and damages.

Fig. 1.

Fig. 2.



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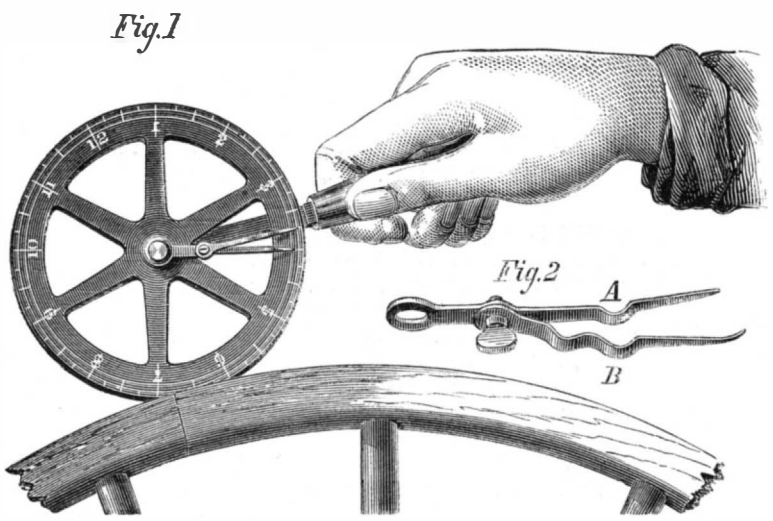
BLACKSMITH'S MEASURING WHEEL.

Mr. Thomas R. Way, of Springfield, Ohio, is the inventor of the device herewith illustrated, for measuring the circumference of wheels and the length of the iron from which tyres therefor are to be made. The peculiarity of the apparatus consists in an extra pointer pivoted to the hand which indicates the wheel measure, for the purpose of deducting from the latter the amount to be allowed for expansion of the metal.

The wheel shown revolves freely on its axle, to which, however, the hand, A, is rigidly affixed. The pointer, B, is secured to the hand, A, by a screw, as shown in Fig. 2, so that its end may be set at any desired distance from that of its support. The device is applied and carried around the wheel to be measured, as represented in Fig. 1, where the hand, A, indicates the length of circumference passed over. The pointer, B, is then fastened with its end at a distance to one side of the hand equal to the amount of expansion of the iron. The apparatus is afterward carried over the tyre, which is cut at the point indicated by B.

The invention may also be employed by coopers for measuring hoops, in which case the extra pointer may be used to indicate the allowance for lap.



BLACKSMITH'S MEASURING WHEEL.

The Novel Steamer.

The saloon steamship designed by Mr. Bessemer, to make sea sickness impossible, is well under way at Hull, England. The framing is nearly complete, and a good part of the outer plating has been put on. The steamer is 350 feet long, 40 feet broad inside of her paddle boxes, and of 2,774 tuns burthen. She will be driven by two sets of paddlewheel engines, acting upon a double set of paddlewheels, situated 100 feet apart, the aggregate power of the engines being no less than 4,600 horse power. The two ends of the ship are alike, and each will be furnished with a rudder. Her most characteristic feature is her saloon, which will be 70 feet long and 30 feet wide, and suspended upon massive pivots at the center and at the extremities. Thus supported, it will be brought under the control of powerful hydraulic gear, worked by the principal boilers of the ship. This gear will be so arranged that it is expected a man will be able to impart to the saloon a rolling motion in relation to the ship precisely the reverse of that which the ship herself receives. The engines, it is anticipated, will drive the vessel at a speed exceeding 20 miles an hour.

THE BLACK NECKED SWAN.

The swan, in one or another of its numerous varieties, is aboriginal in all parts of the globe. A large number are to be found in our beautiful Central Park. The proud and placid white swan is probably the best known of all the species, and is certainly, when on the water, one of the most beautiful of birds. Virgil cited the black swan as a *rara avis*, and as the black variety is indigenous to Australia only, the Mantuan poet's acquaintance with it must have been rather mythical. The black necked swan (*cygnus nigricollis*), of which we present an illustration, is a native of South America, and it rivals the European white bird in the color of its body and wings, while its neck and head are of a splendid black color. In the red color of its bill it also resembles the white swan. A pair of these birds were taken to England and placed in the zoölogical garden of the late Earl Derby, at Knowsley, near Liverpool; and when the collection was dispersed, at Earl Derby's death, the Zoölogical Society, of London, became the possessors. Specimens of the variety are also to be found in the gardens at Amsterdam and Cologne.

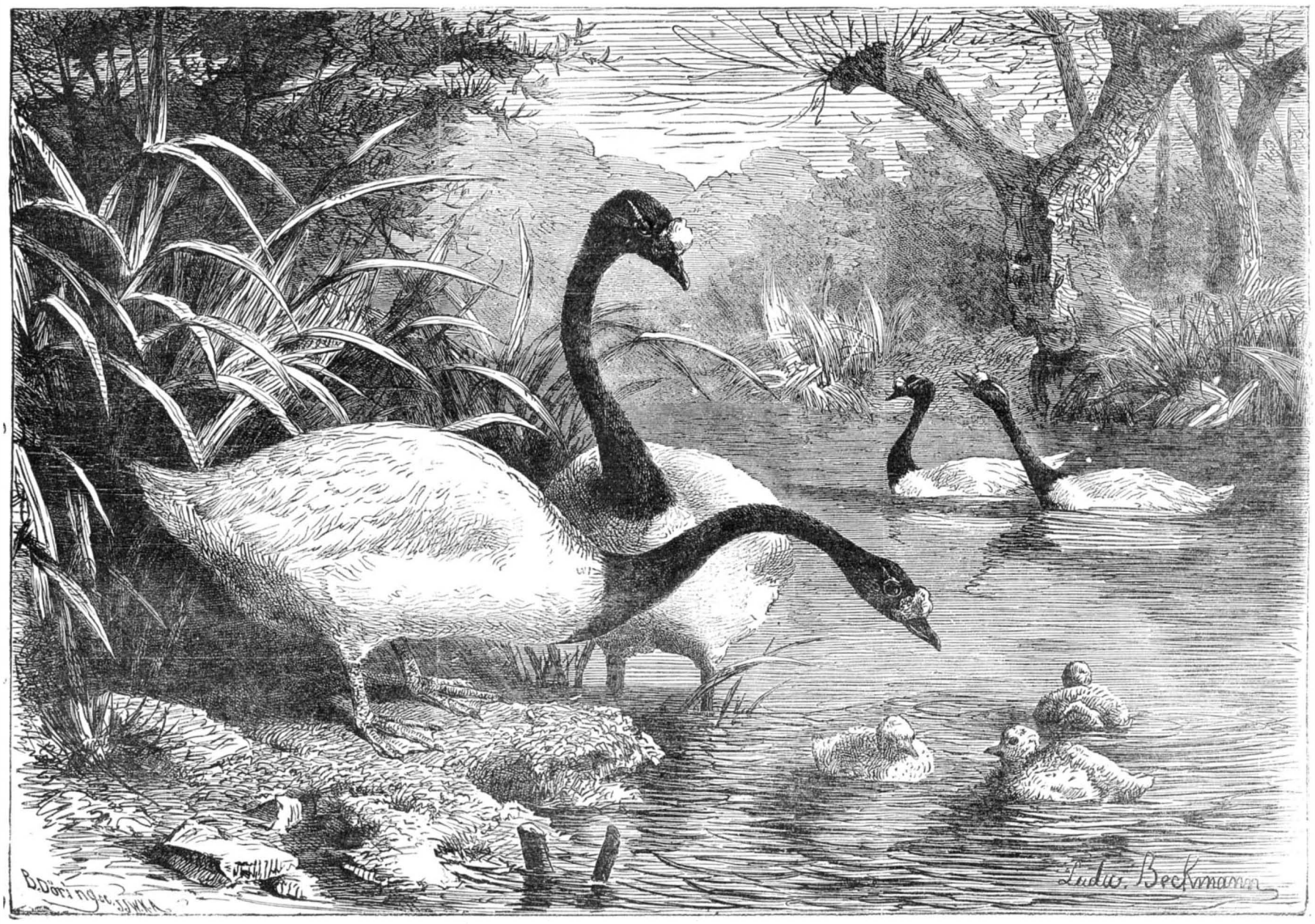
As shown in our engraving, the young birds are singularly undeveloped, their necks being especially at variance with those of the grown birds. But time adds to them not only their singularly graceful form and beautiful plumage, but also the prodigious strength for which the whole species is remarkable, instances being on record wherein men's limbs have been broken by the blows of the wings of infuriated swans, whose pugnacity at breeding time is notorious. The females lay from five to eight eggs, the period of incubation being six weeks.

The Year's Business at the Patent Office.

A statement prepared by the Commissioner of Patents for the coming report of the Secretary of the Interior shows that, during the year ending September 30, 1873, there were filed in the Patent Office 20,354 applications for patents, including reissues and designs; 283 applications for the extension of patents, and 519 applications for the registering of trade marks. Twelve thousand nine hundred and seventeen patents, including reissues and designs, were issued; 235 extended, and 955 allowed, but not issued by reason of non-payment of the final fee; 3,274 caveats were filed, and 476 trade marks registered. The fees received during the same period from all sources amounted to $701,626.72, and the total expenditure to $699,449.69, making the receipts $2,177 in excess of the expenditures. The appropriation asked for the fiscal year ending June 30, 1875, is $693,500. The expenditures included $40,000 for the publication of the *Official Gazette*, $40,000 for printing current drawings, and $60,000 for the reproduction of old drawings. These items were unusual, and account for the absorption of most of the customary excess of receipts over expenditures. The cost of printing current drawings has heretofore been defrayed out of the government printing office appropriations. In regard to the reproduction of old drawings, the Commissioner considers the amount expended for that purpose a good investment, not only with reference to the intelligent advancement of the manufacturing interests of the country, but financially, as they are now being sold at two or three times their actual cost. The Commissioner again invites earnest attention to the great want of additional room for the proper transaction of the business of the Office, stating that is utterly impossible to properly classify the work of the Office, in order to insure its being economically and well done, in the present crowded state of the files, records, and exhibits.

Effect of Artificial Addition of Phosphates to the Food of Lambs.

V. Hofmeister states that two lots, each consisting of three eight weeks old wether lambs, were fed from May to December on hay and potatoes, with a little salt, this diet being selected as characteristically poor in phosphates. One lot received precipitated tricalcic phosphate with its food, the other lot none. During the last 77 days most phosphate was given, the phosphatic diet then containing one fourth more phosphate than was supplied by the vegetable food. The lambs gained about 18 lbs. per head in the six months. Those receiving phosphate showed a distinctly better appetite and drank more water than the others, but their greater increase in weight was insignificant. When slaughtered the only difference between the two lots was a slightly larger weight of stomach, intestines, and lungs, in the case of the lambs receiving phosphate. Five bones of two lambs in each lot were carefully examined. The fresh bones of the



SOUTH AMERICAN BLACK NECKED SWANS.

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lambs fed with phosphate were on an average slightly the heavier; they had a mean specific gravity of 1·384, the specific gravity of the other lot being 1·350. Analysis showed that there was generally more water and less fat in the bones of the lambs fed with phosphate; the dry bones of these lambs also generally contained a slightly larger proportion of incombustible matter; but looking at the absolute quantities found in the bones of the two lots, there was no increase of incombustible matter by feeding with phosphate, but a small increase of phosphoric acid, coupled with a diminution of lime. The amount of fat in most of the bones was very high, reaching to 40 per cent in the dry bone of the fore leg.

Experiments were made as to the digestibility of phosphates. The lambs fed on hay and potatoes (chiefly the latter) digested during six days 25·8 per cent of the phosphoric acid, and 46·0 per cent of the lime contained in their food; and in another experiment of four days, 40·9 per cent of phosphoric acid and 20·6 per cent of lime. In a further experiment of six days, with two year old sheep, on a similar diet, 43·3 per cent of the phosphoric acid and 43·0 per cent of lime in the food were digested. When the lambs received 6 grammes of precipitated phosphate per day, the whole of the extra phosphoric acid was taken up; but when the quantity was increased to 9 grammes, only about half the phosphoric acid was digested. In no case was all the lime of the phosphate taken up, but a greater proportion of the lime was taken up from the larger dose of phosphate. The old sheep received superphosphate. When 10 grammes were administered per day, the whole of the soluble phosphate was digested; but when the dose was increased to 20 grammes, only 64 per cent of the soluble phosphate was digested. As with the lambs, a greater proportion of lime was taken up from the larger dose of phosphate.—*Journal of Chemical Science.*

Photographs in Natural Colors.

After many unsuccessful attempts, I have at last been fortunate enough to discover a method of producing, with great ease and certainty, heliochromic prints whose colors are closely allied with those of nature. I have obtained by my method reproductions of colored glass and stamps. I can also obtain landscapes in the camera, but with colors rather weak in nature, the result, no doubt, being capable of improvement by having recourse to a better adapted apparatus.

My method of operating, at which I have arrived after numerous trials and experiments, I will now describe:

A sheet of paper, with as fine a grain as possible, is plunged into a silver bath made up as follows:

Nitrate of silver	20 parts.
Distilled water	20 "

are taken, and, as soon as a solution has been made, there is added:

Alcohol	100 parts.
Nitric acid	10 "

When the sheet has been thus treated and dried again, it is further plunged into a solution of

Hydrochloric acid	50 parts.
Alcohol	50 "
Nitrate of uranium	1 "

A little zinc white is dissolved into the hydrochloric acid beforehand.

After this double treatment, the sheet of paper is exposed to sunlight for a short time, until its surface has assumed a violet blue tint. It is then immersed again, after desiccation, in the silver, as also in the hydrochloric bath. These operations are repeated until a most intense blue has been obtained, this being the only way to secure very vigorous images.

Before the paper is altogether dry, it is put into another bath, made up by adding a few drops of a solution of mercury, dissolved in nitric acid, to some distilled water. The sheet is allowed to remain from five to ten minutes in this last named bath, and is then dried by contact with blotting paper.

The sheet thus sensitized is then exposed to light under colored glass—a colored magic lantern slide, for instance; and after a period of twenty to thirty seconds in the sunlight, an impression on a white ground is obtained, with all the colors of the model. The colors are more vivid, and the rapidity quite as great, if there is added, to the bath just mentioned,

Saturated solution of bichromate of potash or ammonia	2 parts.
Sulphuric acid	2 "
Chlorate of potash	1 "

To fix the prints in some degree, they are washed in plenty of water, and then immersed in

Ammonia	5 parts.
Alcohol	100 "

After again washing, the impression is put in a bath saturated with an alkaline chloride. Then, after a final washing, the image will be found to resist for a considerable time the action of diffused light.

ACTION OF COLORED GLASS.

1. Much greater rapidity is obtained if the chloride of silver paper is darkened under violet or blue glass.

2. If, on its exit from the nitrate of mercury bath, the sheet is exposed under a colored glass, and there are interspersed, between the sunlight and the glass, screens or glasses of different colors, it will be observed that the colors appear more rapidly under the yellow, green, and red screens, than under the blue and indigo ones.

COMPLEMENTARY COLORS.

The phenomenon of complementary colors, observed by M. Becquérel when plunging the impressions in ammonia, is exceedingly easy to produce with paper. To effect this, it is only necessary to put the print, after it comes out of the frame, into a solution of carbonate of soda, and then plunge it, after washing, in a solution of nitrate of lead, and expose it to sunlight in a bath of an alkaline chloride. The phenomenon may also be produced in several other ways.

To reproduce landscapes in the camera, it is necessary to prevent, as much as possible, the action of diffused light, and to do this a cone of cardboard of sufficient length is fixed in front of the lens. The time of exposure with a Darlot lens of about eight inches focal length is from fifteen minutes to an hour, operating with an open stop and in full sunlight.—*M. De St. Florent.*

THE DEEP INJECTION OF CHLOROFORM.

In a paper recently read before the Academy of Medicine, Professor Roberts Bartholow, M. D., says:

It is true that the injection of a few drops of chloroform into the gums for the relief of toothache has been practiced by others, and by myself, with success; but hitherto, as far as I am aware, no one has used the deep injection of chloroform for the cure of *tic douloureux*. Indeed, the hypodermic injection of chloroform has been regarded as improper, owing to the violent local inflammation which follows its introduction to the subcutaneous areolar tissue.

The ill effects produced by the injection of chloroform into the areolar tissue are these: vaporization of the chloroform and consequent gaseous distention of the surrounding parts, painful swelling, inflammation, and the formation of an abscess. The pain experienced by the patient at the moment of injection is also considerable; and as the needle is withdrawn, the chloroform acts with energy on the wounded skin. These are very serious and almost insuperable objections to the hypodermic injection of this agent. The same objections do not hold against the deep injection of chloroform according to the method which I practice for the cure of *tic douloureux*. It is true considerable pain is experienced and swelling arises, but the pain quickly subsides, and no inflammation ensues and no abscess is produced.

The needle is inserted under the upper lip, which is raised, and passed so deeply that its point shall rest near the infra-orbital foramen. The chloroform is then slowly injected. When the needle is withdrawn, firm pressure from the check is made over the point of insertion of the needle, and is maintained for a time to insure the diffusion of the chloroform.

It is generally admitted that injection of the anodyne at the site of pain is not necessary to the relief of neuralgia. The curative effect is supposed to be due to the impression made by the anodyne on the center of consciousness. While this is undoubtedly true, there are many reasons for believing that the local influence of an anodyne on the end organs, the seat of an painful impression, is very serviceable, for pain of peripheral origin is made of two factors, an irritation of the sensory nerves, a realization of this irritation by the centers of conscious impressions. Furthermore, there are good reasons for believing that improvement in the condition of nerves, the seat of a painful sensation, reacts beneficially on the center with which they are physiologically and pathologically connected, although the peripheral pain may be the reflection outwardly of a centric lesion.

It is a singular anatomical fact that the facial vein communicates with the pterygoid plexus and the cavernous sinus; hence an injection of chloroform into the part I suggested and practiced in this operation must reach the brain more directly than by any other route. The effect, hence, may be much more decided than when injection is practiced into remote parts.

Case 1.—Mr. M——, aged about fifty years, married, and by occupation a book keeper; a tall, rather spare man, of nervo-sanguine temperament. His hair and beard are freely sprinkled with gray. Although pursuing a sedentary occupation, he has had considerable outdoor exercise, and led a rather active life. Being in good circumstances, his hygienic surroundings have been favorable. He has lived freely and has always had a good appetite and vigorous digestion. He is accustomed to the daily use, in moderation, of whisky and tobacco.

About two years ago Mr. M. began to suffer with pain in the infra-orbital branch of the fifth nerve. The attacks appeared with more or less frequency during the ensuing eighteen months, and gradually increased in severity.

When he presented himself to me for treatment, he was in the following state: he was emaciated, and his countenance was anxious and worn. Owing to the extreme suffering which mastication induced, he had great difficulty in getting a sufficient supply of food. Every motion of the lip, the gentlest washing of the face, a touch of the cheek, induced a paroxysm of pain of horrible severity. The pain was on the right side of the face, and was experienced in the infra-orbital nerve and its terminal branches. During the paroxysm, the muscles of the face were convulsed, the eye injected, and profuse lachrymation occurred. There was great tenderness to pressure over the infra-orbital foramen, and a slight touch induced a paroxysm of pain. His teeth, although not very good, did not appear to be the seat of the irritation, for no pain was developed by pressure on or by striking them sharply. Raising of the upper lip always caused a severe paroxysm. In consequence of this, talking was painful, and the attempt to smile brought on an agony of suffering, so that he avoided seeing his friends. There were no evidences of intra-cranial disease except neuralgia, nor was there a history of specific infection.

I determined, as the patient was naturally most anxious to obtain relief, to inject chloroform. Charging the syringe with half a drachm of Squibb's chloroform, I passed the needle deeply under the lip, according to the method which I have already described, and injected the chloroform in the neighborhood of the foramen. Mr. W. experienced a very severe paroxysm of pain at the moment: this was succeeded by burning pain at the site of the injection, numbness of the lip, giddiness and sopor, and swelling of the cheek. In rising to walk, he staggered and had difficulty in maintaining the vertical position. He went immediately home and laid down, in consequence of the continued vertigo and drowsiness. The giddiness did not entirely disappear for twenty-four hours or more. The pain ceased and has not since returned, a period of more than three months having now elapsed. The patient did not again present himself until three weeks, being desirous to ascertain, beyond peradventure, that his relief was permanent, a fact which he could scarcely realize after the protracted and agonizing suffering which he had endured. A remarkable improvement had occurred in general condition in this time. He had gained largely in weight, and his countenance wore a cheerful expression, instead of the anxious and suffering appearance which it had before presented.

Case 2.—Mr. E. V. W——, farmer by occupation, aged about fifty-six, a man of medium height, compactly built, and of bilio-nervo-sanguinous temperament. He always had enjoyed good health and led an active outdoor life. About five years ago, he began to experience decided pain in the infra-orbital division of the right fifth nerve. The paroxysms occurred at first at long intervals; within the past year they have rapidly increased, and during the last three months have been almost continuous. During this time, the lightest touch on the surface of cheek, a current of air, washing the face, raising the lower lip, and especially the mastication of food, have given rise to horrible paroxysms. Lately he has found it necessary to eat alone. The frightful contortion of the muscles of the face, and the rolling of tears down his cheek during mastication, have excited so much apprehension in his family and friends as to render this isolation necessary.

As is usual in these cases of *tic douloureux*, the countenance of this patient expressed great suffering. He looked worn and anxious. When giving me his history, he had repeated paroxysms, during which the muscles on that side of the face became convulsed, the tears rolled down his cheeks, he ceased to speak, and his countenance wore an expression of great agony. He described the pains as of two kinds: a sensation of painful vibration in the face, eye, and forehead, and sudden darting pain, of intense severity, shooting up through the jaw to the eye and head. When I lifted up the lip to examine the mouth he had an atrocious attack, and begged me to desist until the paroxysm ceased. There was no disease of the teeth. Besides the neuralgia, he had no symptom of cerebral disease. His functions were otherwise normal. The loss of flesh was plainly due to the difficulty experienced in taking in a sufficient supply of food.

I injected, in the way already described, thirty minims of chloroform. This brought on a severe paroxysm of pain, which continued for a few minutes, but was succeeded by a feeling of relief, numbness of the face and lip, some drowsiness and swelling of the cheek. The relief to the pain lasted nearly twenty-four hours, when a light paroxysm ensued and the injection was repeated. In all, four injections were made in space of a week, but no pain was experienced after the second injection. At the expiration of two weeks, having had, meanwhile, no recurrence of his old malady, he called to say he was perfectly well. As he has not since presented himself, I have no doubt that he continues free from any return of the disease.

EMBALMING THE DEAD.—In the Vienna Exposition there were several specimens of the embalming of parts of the human body. Those exhibited by Dr. Marini, of Naples, were particularly to be noted. One of these was a large round table made of muscles, sinews, etc., of a dark brown color, with a handsome polish. Among his other exploits he petrified Thalberg, the deceased pianist, and the widow is said to keep the corpse in her drawing room. He also embalmed Mazzini, and so well that some of the more economical admirers of that statesman urged that the body should be set up in Rome as a statue, and thus save expense.

SAGACITY OF BIRDS.—Certain facts render it probable that birds, in some manner, become aware of cholera infection in the air. Recent European journals state that at Munich, where several cases of cholera have occurred, the rooks and crows, which flew about the steeples and through the trees of the public promenades, have all emigrated; and the same thing happened during the cholera seasons of 1836 and 1854. According to Sir Samuel W. Baker, the same phenomena occurred at Mauritius, where the martins, which exist in immense numbers the year round, wholly disappeared during the prevalence of the cholera.

QUALITATIVE ANALYSIS OF BENZINE.—Commercial benzine often contains quite a large proportion of petroleum, which leaves a disagreeable odor when the benzine is employed for the removal of grease. A small piece of pitch is placed in a test tube and the suspected liquid poured upon it. Pure benzine will readily dissolve the pitch, forming a tarry mass, while adulterated benzine will be less and less colored in proportion to the amount of petroleum contained in it. Coal tar will dissolve easily in pure benzine, but forms distinct layers when impure material is employed for the solution.

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SCIENCE AND HEALTH.

The American Public Health Association, a body the objects of which are sufficiently indicated by its name, recently held its second annual meeting in this city. A number of interesting and valuable papers by eminent physicians and others were read, of the more important of which we give abstracts herewith.

Dr. Nathan Allen, speaking upon the laws of longevity, pointed out that a mind well cultivated and balanced, cheerful disposition, temperate and regular habits, are great promoters of long life. Hence longevity is found among civilized nations more than among savages. The prerequisites of prolonged life may be classed under the heads of constitution, inheritance, and obedience to laws. It was finally considered that physiology in its practical application is yet in its infancy; and when it is thoroughly understood in the family and the schoolhouse, the duration of life will be greatly increased.

THE HOUSEKEEPER'S RESPONSIBILITY

formed the subject of some excellent remarks by Dr. Edward James, of Dorchester, Mass., in which he said that man is more affected by the kind of food he eats than the lower animals, because he is of a more sensitive disposition. All measures of his life ought to depend on his digestion, and the methods of his housekeeper. The stomach is originally sound. It can digest and convert all proper food necessary for the support of the animal body, if it is suitably selected and prepared. If, after our meal, the stomach complains, we have headache, or are languid, nervous, depressed, have pains of neuralgia or indigestion, or our energies are overborne, it must be referred to the way in which we have treated the stomach by putting unsuitable burdens upon it. A large portion of these ills are due probably to our own fault, and to our love of what we call really good eating; but the cook and housekeeper are, more likely, to blame.

Dr. Hamlyn, of Bangor, referring to

DIET,

considered that, in the selection of meat for food, there is too little care. Flesh contains the elements of vicious poison. Butcher's meat contains but a small portion of nutrimene, as shown by French physicians. It is now exposed to the air before serving it for the table. The exposure deprives it of a portion of its nutriment. Animals should be stalled and fed before being offered for food; but so far from that being the case, they are brought here by long travel in cars, worn and harassed. The meat should be prepared at the pastures of the cattle; and if necessary, the law of the nation should secure such a consummation.

THE SANITARY RELATION OF HEALTH AND ARCHITECTURE

was considered by Mr. Carl Pfeiffer as of great importance, inasmuch as the architect furnishes the human body, by means of its dwelling place, its house, with the proper medicine wherewith to regulate its intercourse with what is its chief food and necessity—air. As this chief food exceeds in amount three thousand times that of all other kinds, so in proportion is the science of building a proper house of pre-eminent importance to the science of hygiene. One of the first principles of architecture is that the material of buildings should be dry and porous. The furniture can chill and produce rheumatic affections if it is damp or has been long in an unheated room. Cold bedrooms are breeders of disease unless they have ventilation besides their cold. People sleep in airtight cold rooms and believe they are doing a wondrous thing for their health, particularly if they have the bedroom aired in the morning. All night long the air stays unmoved and becomes slowly poisoned, while the evaporation of the body settles upon the walls and makes the room more and more airtight.

Referring to the

REFUSE OF CITIES,

Dr. C. A. Leas, of Baltimore, recommended great care and regularity in removing the ashes and garbage from the various sections. He urged that carts should be employed in this service, and that ashes and vegetable matter should be kept in separate receptacles, and emptied at regular and stated times.

Dr. Storer, of Boston, read a paper on the same subject, recommending a change in the method of disposing of the offal of slaughter houses. The most effectual way was to build chambers or ovens four or five feet square, where the gases and steam may be burned. Public health demanded that the offal and dead animals of a city should not be permitted to accumulate.

Dr. Russell's report on

YELLOW FEVER IN LOUISIANA

was read by Dr. White, of New Orleans. It was reported that the cases at Shreveport and Memphis were not more malignant than those found in New Orleans, and that the sprinkling of carbolic acid and hygienic measures are almost sure to moderate the disease. It is a strange fact that no single colored person took the yellow fever, and they rarely ever take it unless it is fiercely epidemic.

"For use in this city we have dead oil, and for streets carbolic acid. In applying these disinfectants, we applied 70 per cent of carbolic acid, and a chloride of zinc and iron, precipitated from scrap tin, which we used through water carts by a hose attachment, by which three men, going as fast as a horse could walk, could sprinkle each gutter; and by this means we have sprinkled 150 miles a week. No complaint of the smell of carbolic acid ever came to us. We were able, with dead oil and zinc solution, to disinfect about 120 outbuildings a day."

Dr. White said: In New Orleans they sprinkled carbolic acid on the velvets and silks in houses, as disinfectants, as it could not destroy colors.

General Francis A. Walker, superintendent of the United States census, followed in an interesting paper on

THE STATISTICS OF MORTALITY,

in which the proportion of deaths among all classes was shown, as follows:

	Share of population.	Share of deaths.
Colored	126 in 1,000	137 in 1,000
Irish	48 in 1,000	55 in 1,000
German	44 in 1,000	38 in 1,000
English and Welsh	16 in 1,000	15 in 1,000

The large proportion of deaths from accidental causes among the latter class may be perhaps attributed to the fact that so large a number of the Welsh population are miners. From the severity of our climate, all foreign elements tend somewhat to consumption when on our shores. In the South the native colored furnish a less mortality from consumption than the average, while in the North it is much greater than the average.

Dr. Lewis W. Leeds then read a paper on

THE SANITARY ELEMENTS IN DWELLINGS.

He thought it was a mistake to overheat all the fresh air as fast as it was admitted to our hospitals and public and private buildings. He had come to the conclusion that all artificially warmed air was injurious to animal life. Nature's method of warming was a warm floor, heated by the obstruction of the sun's rays, while the air above is cold.

A report upon the

HABITS OF YELLOW FEVER

was then read by J. M. Toner, M. D., of Washington. One question was whether elevation had had anything to do in the escape from yellow fever. Its favorite places were between the 45th and 100th degrees of longitude, and the 35th north and 35th south degrees of latitude. The strata of air in which yellow fever exists is heavier and lower than the surrounding air. From the facts gathered together, it would seem clear that this disease in the United States never exists above 500 feet. If it can be shown that the existence of yellow fever depends entirely upon the elevation, a great deal will have been done in the investigation.

ATMOSPHERIC ELECTRICITY AND OZONE

was the title of a paper read by Dr. George M. Beard of this city. He said that it has been shown that there are two daily tides of positive atmospheric electricity. In the morning between 6 and 9 o'clock, the atmospheric tide is at its hight, falling somewhat between 2 and 5 P. M., rising again between 6 and 9 P. M., and falling to a minimum between 2 and 5 A. M. Similar variations are noticeable in the months, the tide of atmospheric electricity being highest through the months of January and February, gradually subsiding in the months of March, April, May, June, July, and August, when it is at its minimum, and gradually rising again through September, October, November, and December. It has been stated that there is a relation between ozone and intermittent and remittent fevers; that rheumatism is prevalent when ozone is deficient; and that when ozone is in excess, diphtheria, scarlet fever, small pox, measles, scarlatina, and other cutaneous affections become prevalent.

Comparative researches regarding atmospheric electricity, if conducted to a large extent under government supervision, would help to explain the extraordinary stimulative character of the climate of California, to explain the fact that sunstrokes are almost unknown on the Pacific coast, and perhaps elucidate some of the unknown causes of other wondrous effects of our climate.

Professor Chandler, in the course of remarks on

THE SANITARY CHEMISTRY OF WATER,

observed that the organic matter which is dangerous in water is sewage, and many diseases, especially cases of typhoid fever, have been developed by the presence of these impurities in water. Actual experiment shows that water which remains overnight in lead pipes in New York contains 1-10 of a grain of lead to the gallon. It seems to be well established now that rivers possess the power of self-purification, and the drainage of a great city can be received within an ordinary river without destruction of its wholesomeness. The Croton water brought to this city every day contains 22¼ tuns of mineral matter. To poison the Croton water for one day it would require 3½ tuns of strychnin, and there is not, probably, a tun of strychnin in the world. It would take 114 tuns of arsenic to serve the same purpose. So it may be seen that threats of poisoning the Croton supply during the war were ridiculous.

President White, of Cornell University, delivered an interesting address on

GENERAL SANITARY TOPICS

and proper education in hygiene. He said; "I would have simple text books in physiology introduced in our common schools; but, better still, I would have short courses of lectures by competent physicians. It thus becomes a study of living man by living man to living man. Physiology should be taught throughout a college course. The science of sanitary engineering is not so large that the main elements could not be given. I have great respect for the old curriculum, but the substitution of sanitary studies will well replace some of the now well worn classics."

THE GERM THEORY OF DISEASE IN ITS RELATION TO HYGIENE

was the subject of an able discourse by President Barnard, in which the view was taken that the laws of health and disease were as well defined as those of the mathematics, and the only obstacle was the difficulty attending their discovery. No living organism enjoyed an existence prolonged to an indefinite length, and life began in the germ and ended in dissolution and disintegration. In the human race life was often shortened by ignorance, and in many cases by accident. After discussing the germ theory, the speaker concluded by saying that drugs were already falling into disrepute, and he hoped to see the time when, through medical science, infectious diseases would be extirpated, and men would live out the time that Heaven intended they should.

SOAP SOLUBLE IN SEA WATER (M. Manin).—Oil or fat, 46 parts; resin, 10 parts; fish glue, 40 parts; soda or potash, 1 part; oxalate of potash, 1 part. The oil and resin are saponified as usual, but with an excess of alkali, the glue previously rendered gelatinous by solution in oxalate of potash with constant stirring to 50° or 60°.

ANOTHER newspaper concern is to attempt the passage of the Atlantic by balloon. This time it is the *Evening Herald* of Philadelphia. It is to be a hot air balloon, and is now in process of construction.

Recent American and Foreign Patents.

Improved Hydraulic Brake.

John F. Taylor, Charleston, S. C.—This invention consists in means whereby steam, water and air may be conjointly applied to operate car brakes with great certainty, efficiency and economy. Two steam cylinders and two water cylinders have an outlet tube, so connected with the rams that the introduction of steam in one cylinder results in the expulsion of water from the other. The steam valves and valves of the water outlet tube are connected by intermediate mechanism and operated by one and the same lever. The piston rod of the hydraulic engine is connected with brake bars. Provision is made for readily applying the brakes, in case of rupture or breakage of the connecting pipes.

Improved Apparatus for Cleansing Dyed Wool, etc.

James E. Ackroyd, Chester, Pa.—This invention consists of a trough attached to a tank for holding the wool and the scouring and cleansing mixture, having one side curved from bottom to top, and provided on the inside with fixed blocks or wire netting. Above there is a curved track, on which a carriage having blades projecting down to the curved bottoms is arranged to run forward and backward to force the wool up the sides of the tank and over the blocks. The latter are inclined on the sides against which the wool is forced, and the arms of the truck are hinged so as to swing up and pass over any portion of the wool that may be under the points in going back, so as not to tear and injure the fiber.

Improved Mop Holder.

Elon M. Naramore, Underhill, Vt.—This invention consists of a lateral head piece, attached to a mop stick, between which and a wire clamp the mob is tightly held. The wire clamp is provided with coiled springs, which swing sidewise on pivots of the head piece, with upward extending parts hooked to the sides of the handle.

Improved Wheel for Vehicles.

Michael B. White, McLean County, Ill.—The spoke is provided with a round, shouldered tenon, which enters a hole in the felly. The thimble fitting on said tenon is reduced and screw-threaded for one half its length, and on such reduced portion a nut is screwed, and also a jam nut. The thimble is applied to the spoke tenon with its larger end abutting against the shoulder thereof, and has ribs which take into notches on the spoke, for the purpose of preventing the thimble from turning. When the tyre requires to be tightened, or the felly adjusted, a wrench is applied to the larger nut, and it is turned or screwed back toward the felly until the distance between the spoke shoulder and the felly has been sufficiently increased to produce the desired effect.

Improved Pitman Rod.

Samuel N. Wate, Jr., Danville, Pa., assignor to himself and Peter J. Adams, of same place.—This invention consists in improving the pitman rod connection for which letters patent were granted to the same inventor, Nov. 19, 1872. The forward end of a screw, to which is attached a milled nut, rests against a block which is inserted in the inner end of the inner brass. The body of the screw passes through a washer, and its other end is inserted in the rod. This end of the screw is flat, to prevent the screw from turning when the nut is screwed down against the rod. Bolts, which pass through slotted holes in the straps, fit tight in the rod and brass, and are moved with the latter as they are pushed outward; but the hole through the long strap for one bolt, and the hole for the other in the short strap, are so arranged that, when the screw and nut push out the rod, block, and brass, the straps are drawn in just as much as the screw and nut push the rod and blocks apart, so that all the wear and lost motion is taken up without changing the length of the rod. The two cross bars described in the former patent are taken out, and the two bolts mentioned substituted.

Improved Jig Saw.

Marvin E. Weller, Fort Plain, N. Y.—In the front of the frame is a vertical dovetail groove, in which a corresponding tongue on the adjusting plate fits to control said plate in adjusting it up and down and to hold it. For the latter purpose, an eccentric cam is arranged, provided with a weighted arm, which, when it falls, causes the eccentric to bear the tongue against the walls of the groove with sufficient force to bind it fast. There is suitable mechanism in order to lift the weighted lever and unfasten the plate by the hand used for adjusting said plate, and at or just before the time of adjusting it. Thus only one hand is employed for these two purposes, and the other is free to do other things necessary to be done at the same time. The upper cross head carries a couple of griping jaws pivoted near their lower ends, and curved, outward and then backward, nearly together at their upper ends to provide room for a ball between them, to which a spring is connected. The upper end of the saw, having a slight head upset on it, is placed between the said jaws at the lower ends, and the spring is hitched to the ball, so as to pull it upward between the upper ends of the jaws, which forces the lower ends to gripe the saw and hold it with great force. The lower cross head has two sliding jaws between two inclined plates, and a double spring connected with said jaws, and extending down to an eccentric lever. The saw, also having a small head upset on the lower end, is placed between the jaws at their upper ends, and they are forced up by the two levers between the inclined plates, and thereby forced hard against the saw. These modes of fastening the saw are very simple, and allow of changing the saws with but very little labor and loss of time.

Improved Life Preserver.

George and Charles Palmer, Morris Run, Pa.—This invention consists in making a cape weatherproof, water repellent and inflatable, so that, while it affords the usual protection for sailors and seafaring people, it is also a life preserver.

Improved Bee Hive.

John H. Shook, Normal, Ill.—The feature of novelty in this hive is the arrangement of the honey frames on the comb frames proper, so that both may be supported by the same hinges, and removed from the hive together

Improved Car Brake.

James B. Pelton, Mt. Pleasant, Md.—This invention relates to that class of brakes which are operated by steam from the locomotive. It consists in the mode of providing the cord with a take-up mechanism by means of a tube and pulley frame, jointed so as to fold up when the trucks come close together, and to unfold as they separate, thereby maintaining a constant tautness in the cord which connects the power with the brake mechanism, and preventing the brakes from being applied unintentionally.

Arms of the Law.

It is doubtful whether any similar weapon of offense, unless it be the sand club or slung shot, is more liable to cause severe injury or even death by a single well directed and heavy blow than the ordinary policeman's "locust." For the preservation of order and peace, it is manifestly necessary to provide men with suitable weapons. A recent invention of Messrs. Simon Beery, of Ohio, and J. W. McDonald, of Texas, for which a patent has lately been granted, is an elastic *baton*, of gutta percha, indiarubber or similar flexible material, which appears to be an improvement over the heavy wooden "billy."

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Improved Wheel Cultivator.

James F. Matchet and Perry W. Smith, Paris, Mo.—The axles at the inner ends of the hubs of the wheels are bent forward at right angles, and after projecting a short distance are bent upward at right angles. The bow is made double, and the parts of its ends are horizontal, parallel with each other, and at such a distance apart as to receive the coupling between them. The ends of the double bow have holes formed through them to receive and work upon the upright parts of the axles. The middle parts of the bow are at such a distance apart as to receive the tongue between them and allow the said tongue and bow to work freely upon each other and upon the bolt that pivots them to each other. The intermediate parts of the double bow are close together, and are rigidly connected. To the rear end of the tongue is pivoted a cross bar, the ends of which are pivoted to arms the lower and forward ends of which are rigidly attached to the upper ends of the upright parts of the axle. The invention consists in the parts above mentioned all pivoted together and moving freely upon each other, in combination with the bent sectional axles.

Improved Manufacture of Iron and Steel.

Edgar Peckham, Antwerp, N. Y.—The object of this invention is to produce a thorough separation of the impure cinder from the metal, and in this manner purify the iron or steel. This method consists in drawing off and removing from the fire or furnace the impure cinder arising from the ore or pig iron as fast, or nearly as fast, as it is made, and supplying its place (by the use of a flux) with a pure cinder. If the impure cinder arising from the ore or pig iron should be thick, and not liquid enough to separate thoroughly from the metal (as is often the case with cinder arising from ores or pig iron containing silica), enough flux is added to it to make it liquid, so it will separate from the metal, when it is drawn off, and its place supplied with a pure cinder by adding more flux, and in this manner the impurities are separated from the iron or steel. Lime, flint, spar, or lean hematite or specular ore, or any other substance that will produce a liquid cinder free from impurities is used as a flux, depending somewhat upon the character of the ore or pig iron employed.

Improved Tag Fastener.

John M. Goodridge, Norfolk, Va.—The improvement consists in the manner of attaching a hook to the card or label by means of a cross bar. The hook is made of flat sheet metal, and its upper part is in the form of the letter T reversed. The cross of the T is attached to the card. At the end of the vertical part is a double barb, which securely holds the hook in place when it is once attached.

Improved Churn.

Joseph L. Britt and Troy R. Britt, of Raleigh, N. C.—This invention consists of a peculiar and simple arrangement of supports for the dashers and operating mechanism, the said supports are mounted on the churn top, so that the dasher and driving gear are all removed when the cover is taken off, to afford unobstructed access to the churn case.

Improved Edge-Protecting Welt for Boots and Shoes.

John Green, Brooklyn, assignor to himself and Joseph Bach, New York city.—This invention is a welt for the protection of the shoe upper, formed of a long narrow strip of leather or other material rabbeted on the upper side to receive the upper, and bent or molded to conform to the shape or outline of the sole.

Improved Belt Clamp.

Eleazer Ainsworth, Wilmington, Del.—Each clamp consists of a lower base piece and a top piece, which are connected by suitable thumb screws. Both pieces are grooved at their inner sides, taking hold of the belt-like jaws to prevent its slipping. The top piece is rounded off at one side and straight at the other, so that it may be swung open on one screw, and be quickly attached to the belt. The hole for the other thumb screw in same piece is slotted for opening and closing the same on the belt. The ends of under piece are provided with recesses, and at their outer edges at the off-side of the belt ends with lugs. Rods extend longitudinally in recesses and connect the clamps, having right and left hand screw threads, with nuts working thereon. A ratchet is placed centrally on the rods for turning the same. After the clamps are applied, the rods connect them, as the lugs serve to retain the nuts in fixed position. Each turn of the ratchet produces then the gradual approach of clamps, and, consequently, the tightening of the belt for lacing, etc.

Improved Refrigerator.

William M. Baker, Fortville, Ind.—This invention relates to certain improvements upon the refrigerators patented by the same inventor December 21, 1872, and May 6, 1873: and consists mainly in providing, by a compact arrangement of the ice chamber, in combination with the cold water and air chambers, a larger space for the provision chambers, and a complete and uniform ventilation of the same.

Improved Copy Holder.

Walter R. Carter, Brooklyn, N. Y.—This invention consists of a couple of long thin bars, supported horizontally side by side in a stand of any suitable kind and material for holding written or printed papers to be copied between them, to expose the line directly above the edge of one of the bars which serves as a guide to the copyist, the paper being drawn up, as each line is copied, to expose the next.

Improved Refrigerator and Cooler.

Canada D. Hicks, Bowling Green, Ohio.—This invention consists in an outer box provided with doors in front, and at each end of its top, and is lined with galvanized iron. In the middle part of the case is placed a box also made of galvanized iron, and which is so supported as to leave a space between it and the lining upon its top, bottom, back, and sides. The inner box is designed to receive things to be cooled or preserved. In the spaces at the ends of the outer box are placed vessels to receive liquids to be cooled, and which are made of such a shape and size as to leave spaces between them and the lining and the box for ice. Pipes lead into the vessels through the bottom of the case, and are designed to extend to the casks or other receptacles in which the beer or other liquid is kept, so that the said liquid may be forced into the said vessels by force pumps.

Improved Picket Fence.

Robert H. McGinty, Moulton, Texas.—This fence is composed of two kinds of posts. Those forming the greater number rest upon the ground. The others are arranged at intervals, and are longer than the posts first mentioned. The distinguishing features of the fence are the zigzag base and straight top. The posts (both long and short) are arranged in panels which brace alternately in each direction, but the tops of some of the posts are brought to a line of wire. The wires are bound together between the posts by links which are so applied that the wires are drawn tightly against the sides of the posts, thus binding all of them together, and rendering the fence strong and substantial. A fence is thus made of short timber of the most durable kind, one well calculated to resist the currents of water as well as wind.

Improved Cosmetic Bottle.

Mary H. Huntington, Watertown, N. Y.—This invention consists of a cup on the top of the bottle or on the stopper, so arranged that some of the contents of the bottle will flow into it when the bottle is laid on one side, and be held conveniently to be taken up by a sponge, brush, or other article for use, and the remainder will flow back into the bottle again when it is placed upright. The object is to avoid the use of a separate cup and the waste attending it, as in the present mode of using cosmetics.

Improved Reel for Harvesters.

John Werner, Jr., Prairie Du Sac, Wis.—The journals of the reel revolve in bearings, which slide upon bars in which several holes are formed to receive pins or bolts, so that the bearings may be moved to adjust the reel forward and back. To the bars also are pivoted the upper ends of connecting rods, the lower ends of which are pivoted to the outer arms of bent levers, which are pivoted at their angles, and in a reversed position, with respect to each other, to a bar of the frame. To the inner arms of the bent levers are pivoted the ends of another connecting rod. By this arrangement the two bars will be made to move exactly together, so that the reel will always be raised and lowered squarely. The reel may also be raised and lowered by operating a suitable lever and held securely in any position into which it may be adjusted.

Improved Bolt and Rod Cutter.

Lewis H. Smith, Stryker, O.—This invention consists of a main cutter or lever or bar, to which is attached an eccentric lever, which bears on the revolving wheel of a sliding cutter acting on the bolts or rods. The opening of the cutters is produced by the action of the eccentric lever on a curved lever having its fulcrum on the main cutter piece, and acting also on the sliding cutter.

Improved Car Coupling.

Oscar Taylor, Grand Rapids, Wis.—The bumper head is made in two parts, upper and lower, divided horizontally and in the direction of their length. The upper part near its inner end has a rounded projection which fits and is pivoted in a corresponding recess in the lower part. At the forward end of both parts are shoulders. Between these enters the coupling bar, the end of which has corresponding projections which engage with said shoulders. To the inclined inner surface of the lower part is attached a spring which is held down against said inclined surface by projections of the upper part, and which, when said upper part is raised in uncoupling the cars, raises the shoulder of the coupling bar. The upper part is raised to uncouple the cars by a cord attached to its forward end, and which leads up to the platform or top of the car, or to both places.

Improved Scaffold Pole Clamp.

Henry Haering and Herman Alles, New York city.—For fastening the horizontal poles to the vertical poles of scaffolds, it is proposed to have a short lever pivoted at the middle in a yoke next to its bottom end, so that the lower end, which is curved to fit the side of a round pole, will embrace a horizontal pole and press it tight against the side of the vertical pole. The yoke embraces the vertical pole and is powerfully drawn against it by an eccentric lever pivoted in the bars at the open end on the side of the vertical pole opposite the lever. By this means the upper end of the lever is forced against the vertical pole above the yoke, so that points upon said extremity, as well as upon the face of the eccentric lever, will be driven into the pole and prevent the clamp from slipping down. The eccentric lever is fastened with a binding chain pressed around the pole and attached to it. The lever, which clamps the horizontal pole, is detachably connected to the yoke, so that the yoke and the eccentric lever may be used without the clamping lever for a splice clamp for clamping two poles together lengthwise, according to a method heretofore patented by same inventors.

Improved Piano Action.

Frederick L. Trayser, Maysville, Ky.—This invention consists of a combined repeating and back check attachment to the French grand action, by which it is designed to render said action equal to the most perfect repeating action. The attachment consists of a notched arm on the hammer rod and an adjustable headed screw on the jack, so contrived that, as the hammer drops from the string, it is caught by the head of the screw in the notch of the arm and held in check about a quarter of an inch from the string, to allow it to vibrate. The rebound is prevented by the heel of the arm below the notch bearing against the head of the rod. The arrangement of the jack, hammer butt, notched arm, and adjusting rod is such that, after the hammer is caught this way, the key being allowed to rise slowly, the jack will again fall into its notch as soon as the key has risen an eighth of an inch, so that a repetition can be made at any rise of the key above that amount.

Improved Children's Carriage.

John G. Kamphaus, Pittsburgh, Pa.—This invention relates to the construction of carriages for children; and consists in the mode of connecting the axle with the bolster, by means of which concussion and jolting are avoided.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]
From October 14 to October 27, 1873, inclusive.

BESSEMER CONVERTER.—J. E. Sherman (of Bucksport, Me.), Norbiton, Eng.
BOOT TACKS.—L. R. Blake, Brooklyn, N. Y.
DRIVING BOOT TACKS.—L. R. Blake, Brooklyn, N. Y.
FRICTION BEARING.—T. A. Weston, Ridgewood, N. J.
IRON MANUFACTURE.—J. E. Sherman (of Bucksport, Me.), Norbiton, Eng.
LIFT AND FORCE PUMP.—W. D. Baxter, New York city.
LOCK WASHER.—K. H. Loomis (of New York city), London, England.
LOOM.—G. Merrill, New York city.
PASSENGER REGISTER.—J. T. Parlour (of Brooklyn, N. Y.), London, Eng.
RAISING MACHINERY.—T. A. Weston, Ridgewood, N. J.
ROTARY ENGINE.—J. B. Bennett, Brooklyn, N. Y.

Value of Patents,

AND HOW TO OBTAIN THEM.

Practical Hints to Inventors.

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent even when the invention is but a small one. Larger inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe, and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & Co. during the TWENTY-SIX years they have acted as solicitors and Publishers of the SCIENTIFIC AMERICAN They stand at the head in this class of business; and their large corps of assistants, mostly selected from the ranks of the Patent Office: men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office: enables MUNN & Co. to do everything appertaining to patents BETTER and CHEAPER than any other reliable agency.

HOW TO OBTAIN *Patents*. This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawing, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them, they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure my Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row New York, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office. Such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

Rejected Cases.

Rejected cases, or defective papers, remodeled for parties who have made applications for themselves, or through other agents. Terms moderate Address MUNN & Co., stating particulars.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

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Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co., 37 Park Row, New York.

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A reissue is granted to the original patentee, his heirs, or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake, without any fraudulent or deceptive intention.

A patentee may, at his option, have in his reissue a separate patent for each distinct part of the invention comprehended in his original application by paying the required fee in each case, and complying with the other requirements of the law, as in original applications. Address MUNN & Co. 37 Park Row, for full particulars.

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Foreign designers and manufacturers, who send goods to this country may secure patents here upon their new patterns, and thus prevent others from fabricating or selling the same goods in this market.

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The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000; and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Now is the time, while business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address MUNN & Co., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

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Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of the former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension, except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing MUNN & Co., 37 Park Row

Trademarks.

Any person or firm domiciled in the United States, or any firm or corporation residing in any foreign country where similar privileges are extended to citizens of the United States, may register their designs and obtain protection. This is very important to manufacturers in this country, and equally so to foreigners. For full particulars address MUNN & Co., 37 Park Row, New York.

Canadian Patents.

On the first of September, 1872, the new patent law of Canada went into force, and patents are now granted to citizens of the United States on the same favorable terms as to citizens of the Dominion.

In order to apply for a patent in Canada, the applicant must furnish a model, specification and duplicate drawings, substantially the same as in applying for an American patent.

The patent may be taken out either for five years (government fee $20) or for ten years (government fee $40) or for fifteen years (government fee $60). The five and ten year patents may be extended to the term of fifteen years. The formalities for extension are simple and not expensive.

American inventions, even if already patented in this country, can be patented in Canada provided the American patent is not more than one year old.

All persons who desire to take out patents in Canada are requested to communicate with MUNN & Co., 37 Park Row, N. Y., who will give prompt attention to the business and furnish full instruction.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at a reasonable cost, the price depending upon the extent of drawings and length of specification.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1836 will be furnished for $1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent. Address MUNN & Co., Patent Solicitors, 37 Park Row, New York city.

MUNN & Co. will be happy to see inventors in person, at their office, or to advise them by letter. In all cases, they may expect an *honest opinion*. For such consultations, opinions, and advice, *no charge is made*. Write plainly do not use pencil, nor pale ink; be brief.

All business committed to our care, and all consultations are kept *secret and strictly confidential*.

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Stationary and Portable Steam Engines and Boilers. Send for Circular. Clute Brothers & Co., Schenectady, N. Y.

For Bolt Forging Machines, and Holding Vises to upset by hand. J. R. Abbe, Manchester, N.H.

Small Tools and Gear Wheels for Models. List free. Goodnow & Wightman, 23 Cornhill, Boston, Ms.

Wanted—Set of Patterns for a Model Locomotive Engine; also, set for a Stationary Engine. Small size. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

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Notice of Removal—The American Photo Relief Printing Co. (Woodbury Process) have removed to No. 621 North 24th Street, Philadelphia, to which No. please address all orders, &c. I. Carbutt, Manager.

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Belting—Best Philadelphia Oak Tanned. C. W. Arny, 301 and 303 Cherry Street, Philadelphia, Pa.

Mercurial Steam Blast & Hydraulic Gauges of all pressures, very accurate. T. Shaw, 913 Ridge av., Phil.

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Buy Steam Engines and Boilers of Gear, Boston, Mass.

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Notes & Queries

J. W. C. asks: If a cone is 2 feet in diameter at the base, and 30 feet high, and a line is fastened at the top and then wound around the cone at every two feet perpendicular hight, until it reaches the bottom, what is the length of the line?

M. W. asks: If two stakes of equal hight stand 80 feet apart in a horizontal plane, what will be the dip or sag of a chain or cord connecting their tops, the cord being 100 feet long? What is the nature of the curve? Is it elliptic or parabolic?

R. R. asks: How can I restore the color of leather and cloth backs of books? They have suffered from the sun and from dust.

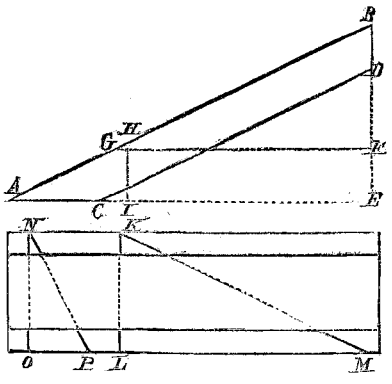
W. C. A. asks: How is the silvering prepared and applied in making glass reflectors?

O. says: Astronomers tell us that the planet Neptune is 40,000 or 50,000 miles in diameter, and cannot be seen with the naked eye. Would it be reasonable to suppose that all the stars that we do see (outside the orbit of Neptune) are over that magnitude?

T. F. de S. says: A friend says that if one takes a gun, and shoots straight up (no wind blowing), that the ball will not come down at the point whence it was discharged from the gun, but that the motion of the earth will move the gun from the ball. He says that one would have to hold the gun at an angle to correspond with the motion of the earth to let the ball come down at the spot whence it started. Is this so?

P. S. A. asks: How do lapidaries cut, grind and polish amethyst and other quartz and hard stones? Answer: The rough stones are first cut to a plane surface by means of a slitting mill. This consists of a thin circular piece of iron like a circular saw, without teeth, however, the periphery of which is covered with diamond dust. It is made to revolve rapidly, and the stone applied to its edge. The stone is then taken to the roughing mill where the surface is prepared for polishing. The roughing mill consists of a revolving leaden disk covered with emery. This gives a smooth surface to the stone, which is lastly polished at the polishing mill. The polishing mill is a revolving leaden disk kept covered with rottenstone and water.

E. R. G. asks: Can you give me directions for getting the bevels for a miter box to saw the lower end of a rake or rafter molding? Answer: As we understand your question, you wish to find the bevels, A C and B D, of the ends of a rafter, A B C D, set at any pitch. Draw a triangle, A B E, making A B represent the inclination of a rafter. Construct a miter box in the usual manner. Draw a square line, K L, across the top of the box. On the side, B E, of the triangle, lay off a distance, B F, equal to K L, the extreme width of the box. Draw G F, perpendicular to B E, and note the point, G, in which it cuts the side, A B, of the triangle. From the point, L,



in the miter box, lay off on the outer edge a distance, L M, equal to G F. From the point, K, on the other outer edge, draw a line connecting K and M. This gives the bevel for A C, the lower end of the rafter. To find the bevel for, B D, draw another square line, N O, across the miter box, and lay off, on the side A E of the triangle, a distance, A I, equal to K L or N O, the width of the miter box. From I draw I H perpendicular to A E; and from O, lay off a distance, O P, equal to I H. Then N P represents the bevel at which the upper end of the rafter is to be cut. These constructions are based on the principle that the angles of the miter box are the complements of the angles B A E and A B E.

S. Y. O. asks: 1. Is it a fact that the animal body, especially that of man, is heavier when asleep than when awake? In other words, is there a power to counteract gravitation in the living human body? 2. Is it an established fact that tables are moved by the mere act of the will by so-called mediums? Answers: 1. We think not. 2. No.

E. H. F. says: If I take a piece of plate looking glass and cut a fine line through the amalgam coating on the back, and then set this glass firmly on and perpendicular to the surface of a plane table, so that the line on the glass will be truly perpendicular to the table, and (turning the face of the glass northward, at the time of the transit of Alioth, and standing in front of the glass) adjust the table and glass so that the line on the glass shall bisect both the north star and Alioth, will a line drawn truly perpendicular to the plane of the glass, across the plane table, be a true meridian line, making allowance of 17 minutes after the transit to bisect the north star by the line? Or, in other words, would the star, the eye, and the line on the glass be all in the same vertical plane at such time? Could the star, as seen in the glass, be bisected by the line on the glass without bringing the eye into a plane perpendicular to that of the glass? If not, then by reversing the glass, with the table thus fixed with reference to the north star, could a shadow of the sun be bisected by the line on the glass, as seen by the eye, at any other time than when the sun is on the meridian of the plane? The reflection of the eye, as well as the star, in the glass, must be bisected by the line on the glass, at the time of the transit. Answer: To ensure, with the arrangement you propose, the line drawn on the plane table being in the same vertical plane with the line of sight, it would be necessary to have two pieces of glass, and sight through both to the north star. We think there are better plans than this in use at present.

F. T. T. says: The feed pipe of a heater from tank enters the top. The pipe leading to force pump is 18 inches from bottom of heater. The glass water gage or tube is attached so that center of pipe is level with center of glass, that is, 6 inches above and 6 inches below the center of pipe. Pipe is 1¾ inches diameter. On starting engine after a few hours' stoppage, the water always leaves the glass tube, the lower end of which is 4 inches below the lower edge of feed pipe. In the course of 15 minutes all comes right again. Can you explain the reason? Answer: It may occur from the formation of a vacuum in the heater, when the engine is not running.

E. C. H.'s calculations as to the rotundity of the earth per mile are correct: but he misunderstands the word rotundity in this connection. The question is: If a straight line tangential to the curve leaves the earth's surface at a particular point, how far will the earth's surface be from a point in the line one mile distant from the starting place? Answer: Eight inches.

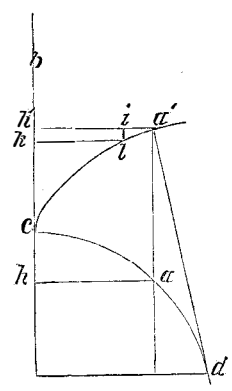
G. W. C. should consult Auchincloss on "Link and Valve Motions." See our advertising pages for booksellers' addresses.

P. asks: How can I preserve leaves? Answer: Press them between pieces of blotting paper, with a heavy weight, until all the juices are dried up.

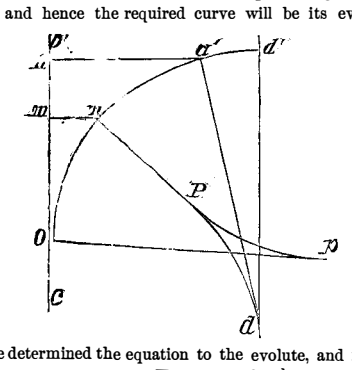
G. W. F. asks: 1. Is spherical gearing illustrated in the Science Record for 1873? 2. Why is the pipe that connects to a steam gage bent into an S form? Answers: 1. Yes. 2. So as to retain water in the pipe.

H. F. B. asks: What is the value of the skivings of sole leather as a fertilizer? The flesh part of the skin is steamed until it becomes a pulp, and then is dried and ground. Is the liquor valuable also? 2. Can bones be made soft so that they will crumble easily by steam pressure? If so, are they worth less or more, when ground, as a fertilizer? Answers: 1. We must ask some of our farmer readers to answer this question. 2. Ground bones are generally considered the best.

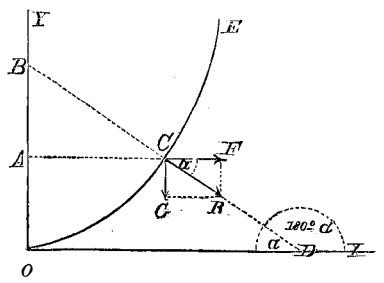
J. E. H. sends the following solution of C. H. A.'s question, on page 187, of our current volume:



Let $h'a'$, $= y$, represent any distance of the ball from the axis $b\,c$. Then, from the laws of central forces, we shall have $h'a'$ $(=y)$ is proportional to the centrifugal force at a'. Let the curve $a'c$ represent the resultant of the centrifugal and gravitating forces at all distances from the axis between zero and $h'a'$, and let $c\,h'$ be represented by x, and draw $k\,l$ indefinitely near and parallel to $h'\,a'$; and draw $l\,i$ perpendicular to $h'\,a'$. Then will $l\,i$ represent $d\,x$ and $a'\,i'$ will represent $d\,y$. Now because x may vary uniformly, $d\,x$ is constant; and because the differentials of x and y represent the components of the two forces at any point, $\therefore dx : dy :: 1 : y$. $\therefore dx = \frac{dy}{y}$, ... (1). Integrating (1) we get: $x = log.y$ . . . (2). As (2) is a well known equation and represents the Napierian system of logarithms, and as the tangents to the required curve must be perpendicular to this curve, therefore the required curve is the evolute to the Napierian logarithmic curve. The equation to this curve I have not investigated; its tangent, however, which is perpendicular to and limited by the resultant curve, is $(\frac{1+y^2}{y})^{\frac{3}{2}}$. The question, as I understand it, may be definitely stated as follows: Suppose a ball to revolve in a horizontal plane, at variable distances, about a vertical axis, $b\,c$, making one revolution per second, and suppose the resultant of the force of gravity and the centrifugal force due the several distances from the axis to form a continuous curve from its greatest distance at d' to the axis at c: Can another curve be drawn whose tangents shall be perpendicular to the resultant curve and which shall also be continuous between the greatest and least distance of the ball from the axis? The answer to this latter question must be a negative; for, as I have shown in the solution, the resultant curve will be the Napierian logarithmic curve, and hence the required curve will be its evolute.



I have determined the equation to the evolute, and find it to be: $u = log.(\frac{1}{4}v \pm \frac{1}{4}\sqrt{v^2-8}) - \frac{1}{8}v^2 \pm \frac{1}{8}v\sqrt{v^2-8} - \frac{1}{2}$. The evolute may be constructed from this equation, and consists of the two branches of P and Pp as above. Answer: It is required to draw a curve, whose tangent shall be perpendicular to the resultant of the centrifugal force and force of gravity at any point, or whose normal shall coincide in direction with this resultant. Suppose the problem to be solved, and that O C E is the required curve, its normal



B C, at any point, C, having the same direction as the resultant, C R, of the centrifugal force, C F, and the force of gravity, C G. Let w = weight of ball, m = mass of ball, g = acceleration due to gravity, v = angular velocity, r = radius of rotation at any point, F = centrifugal force, G = force of gravity. $F = \frac{m \times v^2}{r} = 4m \times \pi^2 \times r$, since $v = 2\pi \times r$; $G = W = m \times g$; tangent of angle F C R $= \frac{CG}{CF} = \frac{m \times g}{4m \times \pi^2 \times r} = \frac{g}{4\pi^2 \times r}$. The equation of the line B D is $y = -\frac{gx}{4\pi^2 \times r} + b$. To find O B, make $x = 0$, O B $= b$. To find A O, make $x = r$, A O $= -\frac{g}{4\pi^2} + b$. Hence subnormal of curve $=$ O B $-$ A O $= \frac{g}{4\pi^2}$ = a constant, and the curve is a parabola.

B. F. asks: Why is it that street cars are not run by compressed air? Could there not be enough air compressed in sheet iron vessels (say in the seats and a hollow or double floor) to run a small engine which would propel the car from station to station? To increase the efficiency, the compressed air might be heated in the cylinder of the engine with a suitable lamp. 2. Could not gas be generated out of water by electricity, with a sufficient force of expansion to run a small engine? 3. As the Nicholson pavement is apt to rot soon, would it not be better to lay a floor of boards, as in the Nicholson, then a thin layer of sand, and perhaps coal tar or cement, and on that basis (while the cement and sand or tar is yet soft) put common paving stone? Answers: 1. We have published accounts of the running of such cars. It is probably an expensive method. 2. Not economically. 3. The Nicholson pavement, as generally laid, does not have a good foundation. Were this attended to, and proper care used in the selection of the blocks, wooden pavements would be very durable.

W. T. H. asks: How can I put quicksilver on glass, to make a looking glass? Answer: Place a sheet of tin foil, the size of the glass, upon a perfectly smooth solid marble top table, and carefully rub down all the wrinkles in the metal with a brush, taking care not to break the foil. Then pour over it a small portion of mercury, and rub it over the tin foil gently with a clean piece of very soft woolen stuff. Then pour on as much mercury as it will hold, placing a strip of cloth around the edges to prevent waste, and slide a perfectly clean and dry sheet of glass over the surface of the liquid metal, beginning at one end and ending at the other. Some experience is necessary in sliding the glass, to make a perfect mirror. Afterwards the glass is placed under heavy weights, to remove superfluous mercury.

O. M. says, in reply to the question of E. C. M., p. 250, as to where a body sliding down the side of a hemisphere whose base is horizontal, will leave the side: I think it will not leave it at all; for after it starts, there will be, as it were, two forces acting on it, the original moving force accelerated by the force of gravity, acting in a line tangential to the sphere, and the force of gravity acting in a line perpendicular to the base. The tendency would then be to move in the diagonal of these two forces, which lies within the base of the hemisphere; hence it would never leave the side. Answer: When the body is at its starting point, the propelling force is applied tangentially, or in a horizontal direction. Hence the resultant motion will be that due to motion in a horizontal direction and vertically downward; and this resultant may fall without the base of the hemisphere.

F. H. M. asks: Is there any metal, or composition of metals, or any other known substance, that will break the attractive power of a magnet if placed between it and its armature? Answer: We think not.

C. W. C. asks: How can I plate polished steel with nickel? Answer: See page 266, current volume. Probably it will be cheaper and more satisfactory for you to send the articles to an establishment where they make a specialty of such business.

F. W. W. asks: 1. Is there any known chemical which, if contained in an airtight chamber, would make sufficient heat to boil water? 2. Is there any known combination of chemicals which will have the desired effect? 3 Is there any known chemical which, if confined in an airtight vessel, will burn and make considerable vapor? Answers: 1, 2. Yes. Lime and water. 3. Yes. Gunpowder.

E. W. asks: How can I make Russian sheet iron? Answer: Russian iron, so called, is not made in Russia exclusively, if indeed any that we use comes from that country. Very pure iron is used in the manufacture of these sheets. The glossy appearance is produced by heating the sheets, moistening them with a solution of wood ashes, and passing them through polished steel rollers.

C. V. D. says: A vessel, 6 feet in diameter at the bottom and 5½ feet at the top, is 6 feet deep. How can I estimate the amount of outward pressure upon the hoops of said vessel? What is the least amount of common hoop iron that will resist the pressure, the vessel being filled with water, and where should the hoops be placed? Answer: If the vessel is filled with water the pressure on the base is equal to the weight of a prism of water whose base is equal to the base of the vessel, and whose hight is equal to the hight of the vessel. The pressure on the sides of the vessel is equal to the weight of a prism of water whose base is equal to the area of surface pressed, and whose height is equal to the distance of the center of gravity of the vessel below the surface of the water. Knowing the tensile strength of the hoops to be used, their size can readily be proportioned.

L. S. asks: How can I get rust, caused by salt water, off fine steel instruments? I cannot use emery, a file, or anything of the sort. Answer: If there are parts that you cannot reach with any rubbing instrument, you probably cannot remove the rust. We have an idea however, that you can succeed in arranging a cloth or brush so that you can polish every part; and in this case, you can clean the instruments with oil and fine brick dust, afterwards applying some polishing powder.

D. L. S. asks: How can I remove deep scratches from a pianoforte case? Answer: This is work for an expert, and we hardly advise you to attempt it. The scratches, when very deep, are sometimes filled with a cement which is colored to match the wood, and then the whole is re-varnished. In ordinary cases, very fine sand paper is used. The wood then requires to be polished and varnished.

A. T. asks: What book gives, in the most condensed form, the relative strength of metals and woods? I also want books on the workings of the different trades, as text books for a class in mechanics. Answer: We advise you to correspond with Professor R. H. Thurston, Professor of Mechanical Engineering in the Stevens Institute of Technology, Hoboken, N. J. We are sure that he will be glad to give you the desired information, while his experience and ability will make his reply of peculiar value.

P. P. H. asks: 1. What power is required to drive a sewing machine? 2. To what pressure can air be conveniently compressed in a suitable receiver by the air pump? Answers: 1. From 550 to 1,000 foot pounds per minute, varying with different machines. 2. The inventor of the Giffard injector states that he has compressed air, by the use of a piston of his own design, to more than 1,000 atmospheres, or till it attained a pressure of about 15,000 pounds per square inch.

W. L. C. says: We have occasion to use a large number of hard rubber balls for testing castings by water pressure, and we find that the balls get dry and hard, consequently soon crack and break. How can they be kept soft and pliable? Answer: Probably you cannot restore their former qualities. Your best plan will be to purchase a superior class of rubber.

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S. H. D. says: 1. A safety plug to a steam boiler melted out when the boiler was being blown off; the fires were drawn and the steam gage indicated about 35 lbs. of steam: what was the cause? 2. Of what alloy or metal should a safety plug be composed? 3. How many years has the SCIENTIFIC AMERICAN been published? Answers: 1. It is quite probable that the iron was corroded around the plug, so that it was shaken out by the shock due to the contraction of the boiler. . For a recipe for fusible metal, see p. 281, vol. 26. 3. The first number of the SCIENTIFIC AMERICAN was issued n August, 1845.

J. F. W. says: I wish to watch the inside of a small thin copper cylinder. Can I cut a slit in it, and then cement a piece of glass over the aperture so that it will stand 200 lbs to the square inch? I am afraid of unequal contraction and expansion. Could I cement it to any better advantage in a cast iron cylinder? Answer: The Committee of the Franklin Institute, who made experiments to determine the cause of boiler explosions, used a boiler having an opening covered with glass. We believe the glass was broken several times, under high pressures. Your best plan would probably be to make the joint with rubber.

E. J. C. asks: Will kerosene oil do in place of petroleum for steam boilers? Answer: We think not.

W. R. F. asks: 1. What is the best and cheapest way of making an exhaust air blower, to take the dust from a small emery grinder? 2. What is the cause of the clinking noise heard in cold steam pipes when steam is let on? 3. When does the Fair of the American Institute close? Answers: 1. It can be done by enclosing a shaft with vanes, in a box, having suitable openings. It will probably be more satisfactory for you to purchase a blower from an established manufacturer. 2. It is caused by the impulse of the condensed steam acting in a vacuum, and by the movement of the pipe as it expands. 3. On November 15, unless extended for one week by vote of the Board of Managers.

J. F. C. asks: 1. Could not drills be used with a rotary movement in boring rock, as is done in boring metals? 2. Could not some form of acid or solvent be used to facilitate the boring of rock? 3. What are the comparative advantages of the different forms of explosives for practical use in blasting? 4. In clearing fields of stone, would it save labor to use the more powerful explosives instead of ordinary blasting powder? Answers: 1. They would get dull too quickly. 2. Agents that would soften the rock might perform the same office for the drills, and in any case the process would probably be too expensive for general use. 3. Giant gunpowder is probably the most economical. 4. Yes.

J. R., Jr. asks: 1. What is the longest distance you have known steam to be conveyed from the boiler to the engine, as for steam pumps in shafts and mines? 2. How far do you think it could be conveyed to have an available working force, from a boiler of 125 lbs. pressure, if well boxed and packed? We wish to place a pump about 2,500 feet from the boiler. Answer: We think you can carry out this plan successfully if you use a large pipe, protect it carefully, arrange expansion joints at suitable intervals, and put in efficient traps to carry off the water. We advise you to have plans prepared by a competent engineer before putting up the pipe.

F. H. C. asks: What is the nominal horse power of the largest steamer on Long Island Sound, also what is the indicated horse power? Answer: Nominal horse power, by English Admiralty rule, 580. Indicated horse power, about 3,000.

C. J. H. asks: 1. At what surface speed should I run common emery wheels (wood covered with leather) to get the best result in grinding and polishing malleable cast iron? 2. Is there any better way to attach emery to leather, than with good glue? 3. Where is the best (sharpest) emery obtained from? 4. Can corundum be obtained in market, in grades like emery? Is it superior to emery in abrasive qualities, enough so to pay for the difference in cost? Answers: 1. About ¾ of a mile a minute. 2. We think so. 3 and 4. Where emery secured to leather is used, it stays on so short a time that the cheap grades of emery answer as well as the better qualities. Corundum can be obtained, but its use is not recommended in this case, for the reason given above.

M. W. says: By accident I got some zinc mixed with type metal. How can I separate them or can they be made to work together? There is only a small amount of zinc in it, just enough to give it the appearance of cold metal in the cast. Answer: The zinc can probably be separated by vaporizing it. This is, however, a rather difficult operation, and you will scarcely succeed unless you have had some experience in the method.

Y. E. asks: 1. In calculating the horse power of a boiler, do you count any of the breeching, or do you count nothing but the actual fire surface of the boiler? 2. What is the best dress to put on a circular saw when cutting pine timber? 3. How is naphtha oil manufactured? 4. What is benzine made from? 5. What horse power has an engine of the following dimensions: Cylinder 9 x 16 inches, working at 63 revolutions per minute, with a pressure of 70 lbs. to the square inch? 5. Did the great transatlantic balloon burst from the high pressure of gas, or did Professor Donaldson cut a hole in it? Answers: 1. Take only the effective heating surface. 2. It is hard to give a general rule, as much depends on the size and quality of the timber. 3. It is a natural product similar to petroleum. 4. It is ordinarily prepared from coal tar oil. 5. The data furnished are incomplete. Probably the mean pressure of steam is not 70 lbs., and there are some deductions to be made for back pressure and cushion. But using these figures, we have horse power = $63{\cdot}6 \times 70 \times 63 \times 2 \times 16 \div 33{,}000 \times 12 = 22{\cdot}7$ nearly. 6. We expect no one but Mr. Donaldson could give a correct reply to this question.

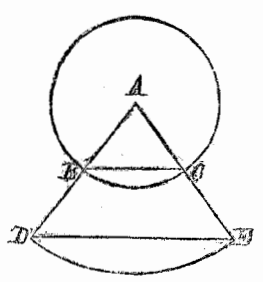
C. D. M. asks: 1. What horse power would a propeller engine, 8 inches in diameter x 8 inches stroke, have? 2. Would you advise using a square water tube boiler to supply steam for the above engine? It is to be used in a small yacht, 40 feet keel x 10 feet beam. 3. How large ought a boiler to be for this engine? Answers: 1. It depends on piston speed and steam pressure. 2. We think you had better use a cylindrical boiler, of the same general character as those now used on ocean steamers. 3. Allow from 18 to 20 square feet of heating surface per horse power.

J. S. asks: In constructing a compound microscope, what are the focal distances and diameters of the glasses to be used, to produce a magnifying power of 80? What are the distances that the glasses should be placed from each other? Answer: Use for the object glass a plano-convex lens, ⅛ inch focus, with its plane side towards the object and its aperture one fifteenth of an inch. At the distance of about 6 inches from this glass, place the eye glass, which, in its simplest form, is a double convex lens. The magnifying power can be increased somewhat by increasing the distance by means of a draw tube between the eye glass and the object glass, but this is at the sacrifice of distinctness.

G. K. M. asks: How can I make paint adhere to zinc? Answer: Dissolve 1 oz. nitrate of copper and 1 oz. sal ammoniac, in 64 ozs. water. Then add 1 oz. hydrochloric acid. Apply this mixture to the zinc; and when it is dry, paint it, using mineral paint. M. M. M. should use this recipe for painting galvanized iron.

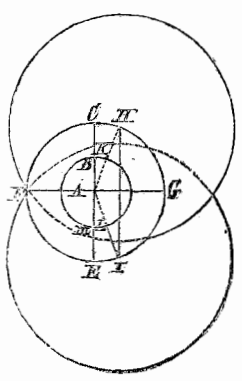
D. H. S. Jr. asks: 1. In fastening pulleys or straight gear to vertical shafting, ought the keys to be driven up or down? In securing bevel gear, ought the keys to be driven with or contrary to the thrust? By thrust I mean the tendency of the wheel to push out of mesh. 2, What scale of measurement is used in expressing the gage of a saw? Answers: 1. Drive the key so that the thrust of the wheel tends to tighten it. 2. There is a great lack of uniformity on the gage question, in the practice of different manufacturers. In ordering a saw, it is best to write to the maker and request him him to send a cut of the gage he uses.

J. O. R. asks: Will you please give a formula for finding the length of a lever for working a roll valve, diameter of steam chest, travel of valve and throw of eccentric being known? Answer: Let the circle described with A B as a radius represent the steam chest. Knowing the travel of the valve, the chord B C can be found. Then the chord, D E, which represents the throw of the eccentric, being given, A E, the length of



lever can be found by a simple proportion. Example: Diameter of steam chest = 6 inches. Travel of valve = 5 inches. Throw of eccentric = 11 inches. Angle B A C = $5 \times 360 \div 18{\cdot}8496 = 95°30'$ nearly. Chord B C = $6 \times 0{\cdot}672 = 4{\cdot}032$ inches. Lever A E = $3 \times 11 \div 4{\cdot}032 = 8{\cdot}18$ inches.

H. R., S. H., and H. C. say: Locomotive eccentrics sometimes slip round upon the shaft. Bourne, in his "Catechism of the Steam Engine," gives the following rule: "Draw upon a board two straight lines at right angles to one another, and from their point of intersection as a center describe two circles, one representing the circle of the eccentric, the other the crank shaft; draw a straight line parallel to one of the diameters, and distant from it the amount of the lap and lead; the points in which this parallel intersects the circle of the eccentric are the positions of the forward and backing eccentrics. Through these points draw straight lines from the center of the circle and mark the intersection of these lines with the circle of the crank shaft, measure with a pair of compasses the chord of the arc intercepted between either of these points, and the diameter which is at right angles with the crank, and the diameters being first marked on the shaft itself, then by transferring with the compasses the distances found in the diagram and marking the point, the eccentric may at any time be adjusted without difficulty." Can you make this a little clearer for us? Answer: In the accompanying diagram, let F G and E C be the two straight lines at right angles to each other, the circle described with A B as a radius be the end view of the shaft, the circle described with A C as a radius be the circle described by the center of the eccentrics, and H I the line parallel to E C, and distant from it the amount of the lap and lead. Then if F G represents the direction of the crank when on the center, H and I will be the positions of the centers of the eccentrics, according to the rule. If, then, the points K and L, in which the lines A H and A I intersect the circle representing the shaft, be transferred to the shaft, by laying off on its end the two diameters, and the chords B K and L M, the eccentrics can readily be set.



E. S. asks: Is hard rubber expansive in its nature when subjected to steam under pressure? Will an india rubber conical plug placed in a hole in the shell of a boiler, so that the steam pressure would make it faster in the plate, expand as fast as the hole increases in size by the expansion of the boiler? Answer: We think the proposed arrangement will answer the purpose very well.

R. asks: How can I take 4 or 5 copies of a letter written in copying ink? Answer: There are several varieties of copying ink in the market, which, their makers state, will take 5 or more copies; but you can probably make the ink you use at present effective by adding a little more sugar.

L. Z. R. says: I have a head of water of 7¼ feet. During 3 months of winter, we cannot run, and I have tried means to use the water over again. Below me is a lake reservoir always full of water above is the lake which supplies my stream. My idea is to run a penstock, 4 feet deep and 3 feet wide, level with the lower lake, through and under my dam: and thence a penstock at right angles to this, 200 feet long, parallel to my dam. This admits the water of the lower lake in said penstock right into the water of the upper lake, whence it must be raised by power into the upper lake for use the second time. On this 200 feet (or longer if needed) penstock 12 or more large cheap windmills with 12 feet arms can be easily erected by simply driving 4 piles to form a frame; wood arms and sails would do, cheapness and strength being the only requisites. What kind of pump will discharge the most water, under 6½ feet head? I want simply a pump to raise the water from the penstock, discharging directly in the water above the penstock, the power being furnished by said windmills. Answer: Your plan is practicable, provided you can depend upon the wind. Probably simple piston pumps, double acting, will answer as well as anything.

H. says: I notice your answer to H. in reference to heating a room by gas. If a gas stove is put up properly, having not less than ⅜ inch connecting pipe, you can use it without any objectionable smell. There is, however, a great difference in gas stoves. In some, the combustion is more perfect than in others. The only secret is to have oxygen enough to mingle with the carbon to produce perfect combustion, free from odor.

R. A. M. says, in reply to C. M. N., who asked how to read the superscriptions on coins: Lay your coins upon a piece of hot iron; the dates will be so visible as to be plainly read. The iron must be red hot, and the coins must be read while hot.

H. says, in answer to S. W. G., who asked as to elevating water: A hydraulic ram is the most economical for your purpose. In order to elevate water 115 feet, you must have a fall of 12 feet from the spring or fountain head. You should excavate, at the exit of the springs, to 3 feet depth, and group together as many outlets of the springs as possible. Box the sides of the excavation with 2 inch plank and cover the same. Make a hole six inches square at the lower end of the box, in the trench or excavation. Cover this hole with a coarse wire gauze, conduct the water from this through a wooden box 4 inches square into a square box in which the ram should set, at the foot of the hill. Close the end of the wood supply pipe, and in this insert a piece of iron pipe 2 inches in diameter to connect with the ram. The supply or wood pipe should be from 25 to 50 feet long. This will take a No. 5 ram, which will receive from 6 to 14 gallons water per minute. The iron discharge pipe that runs up the hill to the reservoir should not be less than 1 inch. The end of this 1 inch pipe at the top of the hill should be inserted in a close, heavy, iron bound 10 gallon cask, at the lowest point. At the opposite point of the cask, insert another piece of pipe 1 inch in diameter, and continue to the fountain or reservoir. The cask is to equalize pressure. The ram will discharge one seventh of the water it receives into the reservoir. For every foot descent in the supply or drive pipe, you have a raising power of 10 feet in the discharge pipe. The object in having the discharge pipe large is to avoid friction; for when the pipes are smaller, there is more friction, the ram labors heavily and is more liable to get out of order. The box in which the ram sets should be made double, with a space of 10 inches, filled with sawdust, to prevent freezing. The discharge pipe and cask should be buried in the ground below freezing point. Avoid sharp angles.

T. L. M. says, in reply to several enquiries as to leaf printing: The bichromate of potash photographic process spoken of by your correspondent J. N. Q. gives but a faint picture, even after lengthened exposure to the sun. The image may be reddened by a dilute solution of nitrate of silver. Blue leaf prints are obtained by floating paper on a strong solution of ferricyanide of potassium, commercially called the red prussiate of potash. They are fixed by simple washing. By Obernetter's process, using salts of copper, pictures may be obtained in different tints of deep red and violet, with intermediate shades; but five different solutions are required, and the process, though not difficult, is rather tedious. Leaf prints of the greatest beauty and delicacy may easily be made by amateurs by the ordinary processes of photography on paper, scarcely any utensils being needed besides those found in any household. Make a solution of sixty grains of nitrate of silver and sixty grains nitrate of ammonia to the ounce of water. Float pieces of albumen paper, obtainable at any photographic supply store, on this solution for half a minute or a minute; pin up to dry in the dark. When dry, lay the paper on a thin board, the leaf on the albumen surface, and upon this a pane of glass. Fasten all together with spring clothes pins, and expose to the sun till the darkened albumen paper begins to show a metallic marbling; then remove from the glass, wash, immerse in a solution of chloride of gold. For a ten cent sheet of albumen paper, 18 by 22 inches, a grain and a half of chloride of gold is needful. Dissolve in a pint of warm water, add a teaspoonful of salt and a little chalk to remove the acidity; leave the washed leaf prints in this till they have assumed a pleasing shade (ten or fifteen minutes will be sufficient); then immerse ten minutes in a solution of hyposulphite of soda, two ounces in ten of water, remove and wash thoroughly; if possible, leave over night in running water. These prints are very pretty. In experimenting with them, I obtained beautiful results by soaking them in aniline dyes; the color does not show on the black ground, but the leaves shine out like exquisite paintings on ebony. The entire expense for chemicals (excepting the aniline colors) is $2.50, for this process; this will be enough for twenty square feet of pictures.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Electricity *vs.* Yellow Fever. By O.

On a New Theory of the Universe. By D. L. S.

On Cement Water Pipes. By M. S.

On Richmond, Va. By H. E. C.

On Compressed Air Cars. By J. P.

On Propylamin. By C. D. D.

Also enquiries from the following:

J. T. T.—J. M. S. Jr.—H. Z. T.—M. F.—C. W.—J. P. L.—F. D. B.—F. C. D.—J. M.—P. L.—S. N.—A. L. B.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal" which is specially devoted to such enquiries.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED FOR THE WEEK ENDING

October 28, 1873,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

27,020.—ENGINE EXHAUST PIPE.—G. Edwards. Jan. 14.
27,033.—CALENDAR CLOCK.—E. M. Mix *et al.* Jan. 14.
27,034.—HARVESTER.—J. Butler. Jan. 21.
27,319.—BENDING SHEET METAL.—O. W. Stow. Feb. 11.

EXTENSIONS GRANTED.

25,936.—CUT-OFF VALVE.—E. R. Arnold.
25,978.—TACKLE BLOCK.—I. E. Palmer.
25,984.—BIT BRACE.—N. Spofford.
26,008.—TELEGRAPHIC MACHINE.—G. M. Phelps.

DESIGNS PATENTED.

6,966.—TOY TARGET.—S. Hamm, Philadelphia, Pa.
6,967.—SPOON HANDLE.—B. D. Beiderhase, New York city.
6,968.—FLY TRAP.—D. K. Thompson, Clark, Pa.
6,969.—SPOON, ETC.—G. Wilkinson, Providence, R. I.

TRADE MARKS REGISTERED.

1,511.—SHINGLES.—L. M. M. Blakely. New York city.
1,512.—FLOUR.—Haxall & Co., Richmond, Va.
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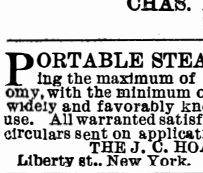

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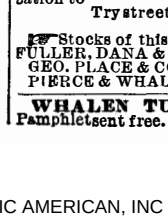

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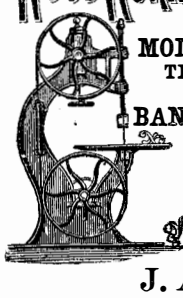

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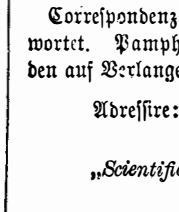

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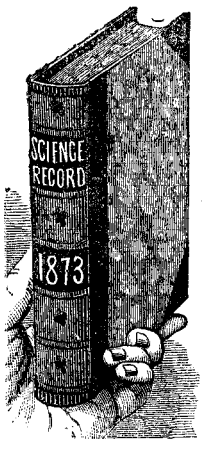

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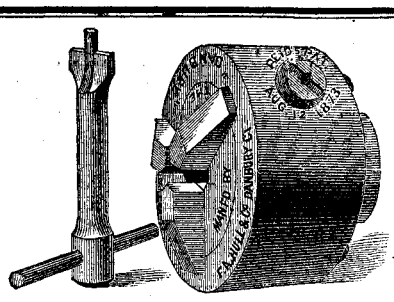

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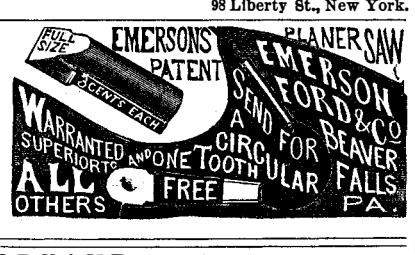

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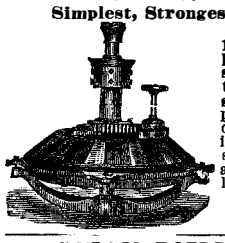
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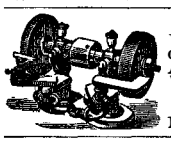
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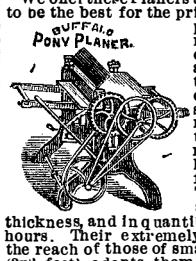

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